Vol. 9, No. 24
December 31, 1984

Energy Research Abstracts

Abstracts 49328-51063

Technical Information Center
Office of Scientific & Technical Information
UNITED STATES DEPARTMENT OF ENERGY

CURRENT AWARENESS PUBLICATIONS ON ENERGY

To provide complete coverage of literature related to major Department programs, announcement publications that are comprehensive in their coverage of certain energy fields are issued regularly. All information in these publications, plus additional backup information, is included in the Energy Data Base of the Technical Information Center; all references are also available for machine searching via the on-line retrieval system, DOE/RECON, and the commercial on-line retrieval systems. Descriptions of these current awareness publications, which are supported either directly or indirectly by the DOE, appear below. Department of Energy components may receive the listed publications free from the Technical Information Center, Office of Scientific and Technical Information, P. O. Box 62, Oak Ridge, TN 37831. Telephone (615) 576-1301; FTS 626-1301.

PUBLICATIONS OF THE TECHNICAL INFORMATION CENTER

Energy Abstracts for Policy Analysis (EAPA)

A monthly abstract journal devoted to the analysis of energy research, conservation, and policy. Scope and coverage are limited to substantive articles or reports and emphasize the following programmatic efforts; legislative, regulatory, and other legal aspects; social, economic, and environmental impacts; regional and sectoral analyses; institutional factors, etc. *EAPA* is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402; domestic subscribers $5.00, foreign $6.25 per copy; annual cumulative index, domestic $16.00, foreign $20.00 per copy. The annual subscription price is $72.00 for domestic subscribers and $90.00 for foreign subscribers.

Energy Research Abstracts (ERA)

A comprehensive semimonthly abstract journal devoted to all areas of energy-related information produced by the Department of Energy, other U. S. government organizations, and foreign governments. *ERA* is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues is $165.00 for domestic subscribers and $206.25 for foreign subscribers. A single issue costs $9.50 (domestic) or $11.90 (foreign).

DOE Patents Available for Licensing (PAL)

DOE is prepared to grant exclusive or nonexclusive, revocable licenses under DOE-owned U. S. patents and patent applications; this semiannual publication provides abstracting and indexing coverage of this literature. *PAL* is available on subscription as PB84-946800 from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. The annual subscription price is $14.00 for domestic subscribers and $28.00 for subscribers outside the North American continent; prices for single issues are $7.00 and $14.00, respectively.

The following monthly update journals are available to the public on subscription from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161; use the identifying order number (PB- No.) when subscribing. The annual subscription rate for one volume (calendar) year (12 issues plus cumulative index) is $75.00 for domestic (North America) and $150.00 for foreign (outside North America) subscribers. A single issue is $7.00 (domestic) and $14.00 (foreign).

***Current Energy Patents (CEP)*–PB84-902800**

Provides coverage of the international patent literature, including patent applications, that concerns any aspect of energy production, conservation, and utilization.

***Energy and the Environment (EAE)*–PB84-914900**

Devoted to information on the impacts of energy-related activities and radioactive and nonradioactive pollutants on the environment.

***Fossil Energy Update (FEU)*–PB84-914600**

Devoted to information on the exploration, development, processing, and use of fossil fuels.

***Fusion Energy Update (CFU)*–PB84-915300**

Devoted to information on controlled thermonuclear fusion, including plasma and fuel research and power plant engineering and conceptual design studies.

***Solar Energy Update (SEU)*–PB84-914500**

Devoted to information on the utilization of solar energy, including biomass and tidal and wind power.

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***Acid Precipitation (APC)*–PB84-901000**

Covers all aspects of acid precipitation, including effects and possible control measures.

***Coal-Based Synfuels (CBS)*–PB84-901400**

Covers all aspects of conversion of coal into gaseous or liquid fuels.

***Coal Preparation and Pollution Control (CPC)*–PB84-900800**

Covers all aspects of coal preparation and cleaning and reducing pollution from its direct combustion.

***Direct Energy Conversion (DEC)*–PB84-946600**

Covers the following areas: photovoltaics, magnetohydrodynamics, electrohydrodynamics, thermoelectrics, thermionics, and fuel cells.

***Geothermal Energy Technology (GET)*–PB84-914700**

Devoted to information on the exploration, development, and utilization of geothermal resources.

***Laser Research (LAR)*–PB84-901100**

Covers all aspects of laser research and development, but excludes applications.

***Nuclear Fuel Cycle (NFC)*–PB84-913400**

Covers all aspects of the nuclear fuel cycle, both front end and back end.

***Nuclear Reactor Safety (NRS)*–PB84-913500**

Covers the following safety aspects: accident analysis, safety systems, radiation protection, decommissioning and dismantling, and security measures.

***Radioactive Waste Management (RWM)*–PB84-902900**

Covers the following management aspects: transport and storage, waste processing, waste disposal, waste storage, radioactive effluents, and shipping containers.

***Solar Thermal Energy Technology (STT)*–PB84-901200**

Covers research in materials, concentrators/receivers, salinity gradients, etc., for development of efficient and reliable solar thermal conversion systems.

***Unconventional Petroleum (UCP)*–PB84-901300**

Covers all aspects of secondary and tertiary recovery of petroleum and of oil shales and tar sands.

INTERNATIONAL ENERGY PUBLICATIONS

The Office of Scientific and Technical Information, Technical Information Center (TIC) cooperates with the following organizations in the publication of international abstract journals: (1) International Atomic Energy Agency, International Nuclear Information System, Vienna, Austria, for *Atomindex;* (2) International Energy Agency, IEA Coal Research, London, England, for *Coal Abstracts;* and (3) International Energy Agency, Biomass Conversion Technical Information Service, Dublin, Ireland, for *Biomass Abstracts.* In each case, the cognizant foreign agency provides the non-U.S. information to TIC for inclusion in the Energy Data Base; in turn, TIC provides the U. S. information for input into the respective journal.

Atomindex

A semimonthly abstract journal providing worldwide coverage of information on nuclear science and technology. *Atomindex* is available by subscription from UNIPUB, 345 Park Avenue South, New York, NY 10010. The cost of an annual subscription, 24 semimonthly issues and semiannual and annual cumulative indexes, is $290.

Biomass Abstracts

A bimonthly abstract journal with comprehensive coverage of information in any step involved in the eventual conversion of biomass to energy. *Biomass Abstracts* is available free to Department of Energy components and contractors from the Technical Information Center. Non-DOE organizations may obtain *Biomass Abstracts* from Biomass Conversion Technical Information Service, Institute for Industrial Research and Standards, Ballymun Road, Dublin 9, Ireland, for 42 IR pounds per year. Make checks payable to the Institute.

Coal Abstracts

A monthly abstract journal providing comprehensive worldwide coverage of information in the field of coal science and technology. *Coal Abstracts* is available to Department of Energy components and contractors from the Technical Information Center. Non-DOE organizations may obtain *Coal Abstracts* from IEA Coal Research, Technical Information Service, 14-15 Lower Grosvenor Place, London SW1W 0EX, England, for 100 pounds sterling per year.

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Vol. 9, No. 24
ISSN: 0160-3604
CODEN: ERABD
December 31, 1984

ENERGY RESEARCH ABSTRACTS

ABOUT THE TECHNICAL INFORMATION CENTER

The Office of Scientific and Technical Information, Technical Information Center in Oak Ridge, Tennessee, has been the national center for scientific and technical information for the Department of Energy (DOE) and its predecessor agencies since 1946. In developing and managing DOE's technical information program, the Center places under bibliographic control not only DOE-originated information but also worldwide literature on scientific and technical advances in the energy field and announces the source and availability of this information. Whereas the literature of science is emphasized, coverage is extended to DOE programmatic, socioeconomic, environmental, legislative/regulatory, energy analysis, and policy-related areas. To accomplish this mission, the Center builds and maintains computerized energy-information data bases and disseminates this information via computerized retrieval systems and announcement publications such as abstracting journals, bibliographies, and update journals. Direct access to the Center's most comprehensive data base, the Energy Data Base, is available to the public through commercial on-line bibliographic retrieval systems. The Energy Data Base and many of the Center's energy-related data bases are available to DOE offices and contractors and to other government agencies via DOE/RECON, the Department's on-line information retrieval system. The Center has developed and maintains systems to record and communicate energy-related research-in-progress information, to maintain a register of DOE public communications publications, to track research report deliverables from DOE contractors, and to test and make available DOE-funded computer software programs with scientific and management applications. The Center also maintains a full-scale publishing capability to serve special publication needs of the Department. To effectively manage DOE's technical information resources, the Center's program is one of continual development and evaluation of new information products, systems, and technologies.

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ABOUT *ENERGY RESEARCH ABSTRACTS*

Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U. S. Department of Energy, its laboratories, energy centers and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. The user should remain aware that *ERA* coverage of non-report literature is limited to that generated by Department of Energy activity.

ERA is comprehensive in its subject scope, encompassing the DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

ERA is available on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information. Inquiries should be directed to the Office of Scientific and Technical Information, Technical Information Center, P. O. Box 62, Oak Ridge, TN 37831.

ERA is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues is $165.00 for domestic subscribers and $206.25 for foreign subscribers. A single issue costs $9.50 (domestic) or $11.90 (foreign). The cumulative indexes will be available in printed form from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, and in microfiche form from the National Technical Information Service, U. S. Department of Commerce, Springfield, VA 22161, and from Engineered Systems, P. O. Box 866, Oak Ridge, TN 37831.

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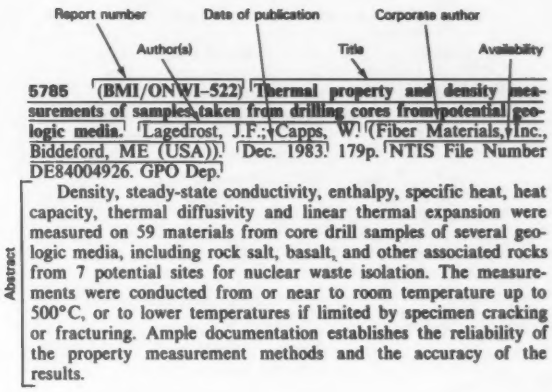
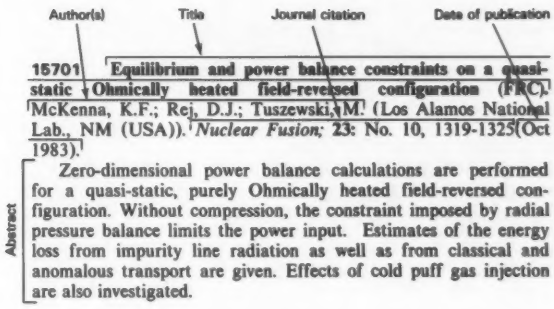
ABSTRACTS IN *ENERGY RESEARCH ABSTRACTS*

The principal elements of abstract entries for a typical research and development report and a typical technical journal article are illustrated below.


Report number
Author(s)
Date of publication
Title
Corporate author
Availability
5785 (BMI/ONWI-522) Thermal property and density measurements of samples taken from drilling cores from potential geologic media. Lagedrost, J.F.; Capps, W. (Fiber Materials, Inc., Biddeford, ME (USA)). Dec. 1983. 179p. NTIS File Number DE84004926. GPO Dep.
Abstract
Density, steady-state conductivity, enthalpy, specific heat, heat capacity, thermal diffusivity and linear thermal expansion were measured on 59 materials from core drill samples of several geologic media, including rock salt, basalt, and other associated rocks from 7 potential sites for nuclear waste isolation. The measurements were conducted from or near to room temperature up to 500°C, or to lower temperatures if limited by specimen cracking or fracturing. Ample documentation establishes the reliability of the property measurement methods and the accuracy of the results.


Author(s)
Title
Journal citation
Date of publication
15701 Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC). McKenna, K.F.; Rej, D.J.; Tuszewski, M. (Los Alamos National Lab., NM (USA)). Nuclear Fusion; 23: No. 10, 1319-1325 (Oct 1983).
Abstract
Zero-dimensional power balance calculations are performed for a quasi-static, purely Ohmically heated field-reversed configuration. Without compression, the constraint imposed by radial pressure balance limits the power input. Estimates of the energy loss from impurity line radiation as well as from classical and anomalous transport are given. Effects of cold puff gas injection are also investigated.

INDEXES TO *ENERGY RESEARCH ABSTRACTS*

Five indexes are provided for approaching the contents of each issue of *Energy Research Abstracts (ERA)*. Each index is preceded by an introduction that details the organization of the index and the principles by which it was compiled. The reader is referred to these introductions for information not found in the index examples that follow.

● Corporate Author Index

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

5785 (BMI/ONWI-522) Thermal property and density measurements of samples taken from drilling cores from potential geologic media. Lagedrost, J.F.; Capps, W. **(Fiber Materials, Inc., Biddeford, ME (USA)).** Dec. 1983. 179p. NTIS File Number DE84004926. GPO Dep.

is indexed as:

Fiber Materials, Inc., Biddeford, ME (USA)

● Personal Author Index

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

Capps, W., *See* Lagedrost, J. F.
Lagedrost, J.F., Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R:US)
McKenna, K.F., Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9:15701 (J:US)
Rej, D.J., *See* McKenna, K.F.
Tuszewski, M., *See* McKenna, K.F.

● Subject Index

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

SALT DEPOSITS
Density
Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R;US)
REVERSED-FIELD PINCH
Energy Balance
Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9: 15701 (J;AT)

● Contract Number Index

DOE technical report literature is indexed using contract numbers. This index contains the contract number with corresponding abstract and report numbers.

AC06-76RL01830	**Fiber Materials, Inc., Biddeford, ME (USA)**	
	9:5785	BMI/ONWI-522

● Report Number Index

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. Patents and conference papers are indexed here as a matter of convenience. When a report is supplied under a File Number, that number is included in the availability statement. A File Number–Report Number Correlation is included for convenience.

BMI/ONWI-522	**9:5785**	**NTIS, PC A09/MF A01. File Number DE84004926, Distribution Category MN-70**

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Karlsruhe, Federal Republic of Germany

IEA Biomass Conversion Service
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National Institutes of Health
National Library of Medicine
Bethesda, MD

Plenum Publishing Corporation
New York, NY

University of Tennessee
Graduate School of Library and Information Sciences
Knoxville, TN

Communication concerning the editorial policy and content of *Energy Research Abstracts* should be addressed to the Editor, *Energy Research Abstracts,* Office of Scientific and Technical Information, Technical Information Center, P. O. Box 62, Oak Ridge, TN 37831.

SUBJECT CONTENTS (NUMERICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 40 first-level and 293 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope definitions and limitations is available as DOE/TIC-4584-R5 from NTIS for $9.50.

01 COAL AND COAL PRODUCTS
- 04 Processing
- 05 By-Products
- 06 Properties
- 08 Waste Management
- 09 Environmental Aspects
- 10 Reserves and Exploration
- 20 Mining
- 30 Transport and Handling
- 40 Combustion
- 50 Marketing and Economics
- 60 Health and Safety
- 70 Regulations

02 PETROLEUM
- 01 Reserves
- 02 Geology and Exploration
- 03 Drilling and Production
- 04 Processing
- 05 Products and By-Products
- 06 Health and Safety
- 07 Marketing and Economics
- 08 Waste Management
- 09 Environmental Aspects
- 10 Policy, Legislation, and Regulation
- 20 Transport, Pipelines, and Handling
- 30 Properties
- 40 Storage
- 50 Combustion

03 NATURAL GAS
- 01 Reserves
- 02 Geology and Exploration
- 03 Drilling, Production, and Processing
- 04 Products and By-Products
- 05 Health and Safety
- 06 Marketing and Economics
- 07 Waste Management
- 08 Environmental Effects
- 09 Artificial Stimulation, Plowshare, etc.
- 10 Policy, Legislation, and Regulation
- 20 Transport, Pipelines, and Handling
- 30 Properties
- 40 Combustion
- 50 Storage

04 OIL SHALES AND TAR SANDS
- 01 Reserves and Exploration
- 02 Site Geology and Hydrology
- 03 Drilling, Fracturing, and Mining
- 04 Oil Production, Recovery, and Refining
- 05 Properties and Composition
- 06 Direct Uses and By-Products
- 07 Health and Safety
- 08 Marketing and Economics
- 09 Waste Research and Management
- 10 Environmental Aspects
- 20 Regulations

05 NUCLEAR FUELS
- 01 Reserves
- 02 Exploration
- 03 Mining
- 04 Feed Processing
- 05 Enrichment
- 06 By-Products
- 07 Fuels Production and Properties
- 08 Spent Fuels Reprocessing
- 09 Transport and Storage
- 10 Marketing and Economics
- 20 Waste Management
- 30 Environmental Aspects
- 40 Health and Safety
- 50 Regulations

06 FUSION FUELS
- 01 Sources
- 02 Processing
- 04 Transport and Storage
- 05 Health and Safety
- 06 Regulations and Policy
- 07 Waste Management
- 08 Properties
- 09 Environmental Aspects

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY
- 01 Physical Isotope Separation
- 02 Radiation Sources
- 03 Isotopic Power Supplies

08 HYDROGEN
- 01 Production
- 02 Storage
- 03 Transport
- 04 Marketing and Economics
- 05 Safety
- 06 Industrial and Commercial Use
- 07 By-Products
- 08 Properties
- 09 Environmental Aspects

09 OTHER SYNTHETIC AND NATURAL FUELS
- 01 Hydrocarbon Fuels
- 02 Alcohol Fuels
- 03 Inorganic Hydrogen Compound Fuels
- 04 Solid Waste Fuels
- 05 Liquid Waste Fuels
- 06 Gaseous Waste Fuels

13 HYDRO ENERGY
- 01 Resources and Availability
- 02 Site Geology and Meteorology
- 03 Plant Design and Operation
- 04 Regulations and Licensing
- 05 Economics and Management
- 06 Environmental Aspects
- 07 Power Conversion Systems

14 SOLAR ENERGY
- 01 Resources and Availability
- 03 Economics
- 04 Environmental, Legal, and Institutional Aspects
- 05 Solar Energy Conversion
- 06 Photovoltaic Power Plants
- 07 Solar Thermal Power Plants
- 08 Ocean Thermal Gradient Power Plants
- 09 Solar Radiation Utilization
- 10 Solar Collectors and Concentrators
- 20 Heat Storage

15 GEOTHERMAL ENERGY
- 01 Resource Status and Assessment
- 02 Geology, Hydrology, and Geothermal Systems
- 03 Geothermal Exploration and Exploration Technology
- 04 Legal and Institutional Aspects

15 GEOTHERMAL ENERGY (CONT.)
- 05 Economic and Financial Aspects
- 06 Environmental Aspects and Waste Disposal
- 07 By-Products
- 08 Geothermal Power Plants
- 09 Geothermal Engineering
- 10 Direct Energy Utilization
- 20 Geothermal Data and Theory

16 TIDAL AND WAVE POWER
- 03 Regulations
- 04 Economics
- 05 Environmental Aspects
- 07 Tidal Power Plants
- 08 Wave Energy Converters

17 WIND ENERGY
- 01 Availability (Climatology)
- 03 Regulations
- 04 Economics
- 05 Environmental Aspects
- 06 Wind Energy Engineering

20 ELECTRIC POWER ENGINEERING
- 01 Power Plants and Power Generation
- 02 Environmental Aspects
- 03 Power Transmission and Distribution

21 NUCLEAR POWER PLANTS
- 01 Power Reactors, Non-Breeding, Light-Water Moderated, Boiling Water Cooled
- 02 Power Reactors, Non-Breeding, Light-Water Moderated, Non-Boiling Water Cooled
- 03 Power Reactors, Non-Breeding, Graphite Moderated
- 04 Power Reactors, Non-Breeding, Otherwise Moderated or Unmoderated
- 05 Power Reactors, Breeding
- 06 Power Reactors, Auxiliary, Mobile, Package, and Transportable
- 07 Regulation and Licensing
- 08 Economics
- 09 Process Heat Reactors

22 NUCLEAR REACTOR TECHNOLOGY
- 01 Theory and Calculation
- 02 Components and Accessories
- 03 Fuel Elements
- 04 Control Systems
- 05 Environmental Aspects
- 06 Research, Test, and Experimental Reactors
- 07 Plutonium and Isotope Production Reactors
- 08 Propulsion Reactors
- 09 Reactor Safety

25 ENERGY STORAGE
- 01 Magnetic
- 02 Compressed Gas
- 03 Pumped Hydro
- 04 Capacitor Banks
- 05 Flywheels
- 06 Thermal
- 07 Liquefied Gas
- 08 Chemical
- 09 Batteries

29 ENERGY PLANNING AND POLICY
- 01 Energy Analysis and Modeling
- 02 Economics and Sociology
- 03 Environment, Health, and Safety
- 04 Natural Resources
- 05 Research, Development, Demonstration, and Commercialization
- 06 Nuclear Energy
- 07 Transport and Storage
- 08 Waste Heat Utilization
- 10 Conservation
- 20 Supply, Demand, and Forecasting
- 30 Policy, Legislation, and Regulation
- 40 Fossil Fuels
- 50 Hydrogen and Synthetic Fuels
- 60 Electric Power
- 80 Consumption and Utilization
- 90 Unconventional Sources and Power Generation

30 ENERGY CONVERSION
- 01 MHD Generators
- 02 EHD Generators
- 03 Thermoelectric Generators
- 04 Thermionic Converters
- 05 Fuel Cells
- 08 Electromechanical Converters

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION
- 01 Buildings
- 02 Transportation
- 03 Industry and Agriculture
- 06 Municipalities and Community Systems
- 09 Education and Public Relations

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS
- 01 Internal Combustion Engines
- 02 External Combustion Engines
- 03 Electric-Powered Systems
- 04 Hybrid Systems
- 05 Flywheel Propulsion
- 06 Vehicle Design Factors
- 07 Emission Control
- 08 Alternative Fuels

36 MATERIALS
- 01 Metals and Alloys
- 02 Ceramics, Cermets, and Refractories
- 03 Composite Materials
- 04 Polymers and Plastics
- 06 Other Materials

40 CHEMISTRY
- 01 Analytical and Separations Chemistry
- 02 Inorganic and Physical Chemistry
- 03 Organic Chemistry
- 04 Electrochemistry
- 05 Photochemistry
- 06 Radiation Chemistry
- 07 Radiochemistry and Nuclear Chemistry
- 08 Combustion Chemistry

42 ENGINEERING
- 01 General Engineering
- 02 Facilities and Equipment
- 03 Lasers
- 04 Heat Transfer and Fluid Flow
- 05 Materials Testing

42 ENGINEERING (CONT.)
- 06 Safety Engineering
- 07 Vacuum Engineering
- 08 Electronic Circuits and Devices
- 09 Waste Processing Plants and Equipment
- 10 Combustion Systems
- 20 Underground Engineering
- 30 Marine Engineering
- 40 Pollution Control Equipment
- 50 Power Cycles

43 PARTICLE ACCELERATORS
- 01 Design, Development, and Operation
- 02 Beam Dynamics, Field Calculations, and Ion Optics
- 03 Auxiliaries and Components
- 04 Storage Rings

44 INSTRUMENTATION
- 01 Radiation Instrumentation
- 02 Radiation Effects on Instrument Components, Instruments, or Electronic Systems
- 03 Miscellaneous Instruments
- 04 Well Logging Instrumentation

45 EXPLOSIONS AND EXPLOSIVES
- 01 Chemical
- 02 Nuclear
- 03 Explosion Detection

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 04 Thermal Effluents Monitoring and Transport
- 05 Site Resource and Use Studies
- 06 Regulations

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 04 Thermal Effluents Monitoring and Transport
- 05 Site Resource and Use Studies
- 06 Regulations

52 ENVIRONMENTAL SCIENCES, AQUATIC
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 04 Thermal Effluents Monitoring and Transport
- 05 Site Resource and Use Studies
- 06 Regulations

53 ENVIRONMENTAL–SOCIAL ASPECTS OF ENERGY TECHNOLOGIES
- 01 Social and Economic Studies
- 02 Assessment of Energy Technologies
- 03 Environmental Impact Statements

55 BIOMEDICAL SCIENCES, BASIC STUDIES
- 01 Behavioral Biology
- 02 Biochemistry
- 03 Cytology
- 04 Genetics
- 05 Metabolism
- 06 Medicine
- 07 Microbiology
- 08 Morphology
- 09 Pathology
- 10 Physiological Systems
- 20 Public Health
- 30 Agriculture and Food Technology

56 BIOMEDICAL SCIENCES, APPLIED STUDIES
- 01 Radiation Effects
- 02 Thermal Effects
- 03 Chemicals Metabolism and Toxicity
- 04 Other Environmental Pollutant Effects

57 HEALTH AND SAFETY

58 GEOSCIENCES
- 01 Geology and Hydrology
- 02 Geophysics
- 03 Mineralogy, Petrology, and Rock Mechanics
- 04 Geochemistry
- 05 Oceanography

64 PHYSICS I
- 01 Astrophysics and Cosmology
- 02 Atmospheric Physics
- 03 Atomic, Molecular, and Chemical Physics
- 04 Fluid Physics
- 50 High Energy Physics

65 PHYSICS II
- 10 Nuclear Physics
- 40 Radiation and Shielding Physics
- 50 Medical Physics
- 60 Solid State Physics
- 70 Theoretical Physics
- 80 Mathematical Physics
- 90 Communication, Education, History, and Philosophy

70 FUSION ENERGY
- 01 Plasma Research
- 02 Fusion Power Plant Technology

99 GENERAL AND MISCELLANEOUS
- 01 Management
- 02 Mathematics and Computers
- 03 Information Handling
- 04 Law
- 05 Civilian Defense

CORPORATE AUTHOR INDEX

PERSONAL AUTHOR INDEX

SUBJECT INDEX

CONTRACT NUMBER INDEX

REPORT NUMBER INDEX

ORDER NUMBER CORRELATION

SUBJECT CONTENTS (ALPHABETICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 40 first-level and 293 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope definitions and limitations is available as DOE/TIC-4584-R5 from NTIS for $9.50.

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS
- 08 Alternative Fuels
- 03 Electric-Powered Systems
- 07 Emission Control
- 02 External Combustion Engines
- 05 Flywheel Propulsion
- 04 Hybrid Systems
- 01 Internal Combustion Engines
- 06 Vehicle Design Factors

56 BIOMEDICAL SCIENCES, APPLIED STUDIES
- 03 Chemicals Metabolism and Toxicity
- 04 Other Environmental Pollutant Effects
- 01 Radiation Effects
- 02 Thermal Effects

55 BIOMEDICAL SCIENCES, BASIC STUDIES
- 30 Agriculture and Food Technology
- 01 Behavioral Biology
- 02 Biochemistry
- 03 Cytology
- 04 Genetics
- 06 Medicine
- 05 Metabolism
- 07 Microbiology
- 08 Morphology
- 09 Pathology
- 10 Physiological Systems
- 20 Public Health

40 CHEMISTRY
- 01 Analytical and Separations Chemistry
- 08 Combustion Chemistry
- 04 Electrochemistry
- 02 Inorganic and Physical Chemistry
- 03 Organic Chemistry
- 05 Photochemistry
- 06 Radiation Chemistry
- 07 Radiochemistry and Nuclear Chemistry

01 COAL AND COAL PRODUCTS
- 05 By-Products
- 40 Combustion
- 09 Environmental Aspects
- 60 Health and Safety
- 50 Marketing and Economics
- 20 Mining
- 04 Processing
- 06 Properties
- 70 Regulations
- 10 Reserves and Exploration
- 30 Transport and Handling
- 08 Waste Management

20 ELECTRIC POWER ENGINEERING
- 02 Environmental Aspects
- 01 Power Plants and Power Generation
- 03 Power Transmission and Distribution

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION
- 01 Buildings
- 09 Education and Public Relations
- 03 Industry and Agriculture
- 06 Municipalities and Community Systems
- 02 Transportation

30 ENERGY CONVERSION
- 02 EHD Generators
- 08 Electromechanical Converters
- 05 Fuel Cells
- 01 MHD Generators
- 04 Thermionic Converters
- 03 Thermoelectric Generators

29 ENERGY PLANNING AND POLICY
- 10 Conservation
- 80 Consumption and Utilization
- 02 Economics and Sociology
- 60 Electric Power
- 01 Energy Analysis and Modeling
- 03 Environment, Health, and Safety
- 40 Fossil Fuels
- 50 Hydrogen and Synthetic Fuels
- 04 Natural Resources
- 06 Nuclear Energy
- 30 Policy, Legislation, and Regulation
- 05 Research, Development, Demonstration, and Commercialization
- 20 Supply, Demand, and Forecasting
- 07 Transport and Storage
- 90 Unconventional Sources and Power Generation
- 08 Waste Heat Utilization

25 ENERGY STORAGE
- 09 Batteries
- 04 Capacitor Banks
- 08 Chemical
- 02 Compressed Gas
- 05 Flywheels
- 07 Liquefied Gas
- 01 Magnetic
- 03 Pumped Hydro
- 06 Thermal

42 ENGINEERING
- 10 Combustion Systems
- 08 Electronic Circuits and Devices
- 02 Facilities and Equipment
- 01 General Engineering
- 04 Heat Transfer and Fluid Flow
- 03 Lasers
- 30 Marine Engineering
- 05 Materials Testing
- 40 Pollution Control Equipment
- 50 Power Cycles
- 06 Safety Engineering
- 20 Underground Engineering
- 07 Vacuum Engineering
- 09 Waste Processing Plants and Equipment

52 ENVIRONMENTAL SCIENCES, AQUATIC
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 06 Regulations
- 05 Site Resource and Use Studies
- 04 Thermal Effluents Monitoring and Transport

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 06 Regulations
- 05 Site Resource and Use Studies
- 04 Thermal Effluents Monitoring and Transport

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 06 Regulations
- 05 Site Resource and Use Studies
- 04 Thermal Effluents Monitoring and Transport

53 ENVIRONMENTAL–SOCIAL ASPECTS OF ENERGY TECHNOLOGIES
- 02 Assessment of Energy Technologies
- 03 Environmental Impact Statements
- 01 Social and Economic Studies

45 EXPLOSIONS AND EXPLOSIVES
- 01 Chemical
- 03 Explosion Detection
- 02 Nuclear

70 FUSION ENERGY
- 02 Fusion Power Plant Technology
- 01 Plasma Research

06 FUSION FUELS
- 09 Environmental Aspects
- 05 Health and Safety
- 02 Processing
- 08 Properties
- 06 Regulations and Policy
- 01 Sources
- 04 Transport and Storage
- 07 Waste Management

99 GENERAL AND MISCELLANEOUS
- 05 Civilian Defense
- 03 Information Handling
- 04 Law
- 01 Management
- 02 Mathematics and Computers

58 GEOSCIENCES
- 04 Geochemistry
- 01 Geology and Hydrology
- 02 Geophysics
- 03 Mineralogy, Petrology, and Rock Mechanics
- 05 Oceanography

15 GEOTHERMAL ENERGY
- 07 By-Products
- 10 Direct Energy Utilization
- 05 Economic and Financial Aspects
- 06 Environmental Aspects and Waste Disposal
- 02 Geology, Hydrology, and Geothermal Systems
- 20 Geothermal Data and Theory
- 09 Geothermal Engineering
- 03 Geothermal Exploration and Exploration Technology
- 08 Geothermal Power Plants
- 04 Legal and Institutional Aspects
- 01 Resource Status and Assessment

57 HEALTH AND SAFETY

13 HYDRO ENERGY
- 05 Economics and Management
- 06 Environmental Aspects
- 03 Plant Design and Operation
- 07 Power Conversion Systems
- 04 Regulations and Licensing
- 01 Resources and Availability
- 02 Site Geology and Meteorology

08 HYDROGEN
- 07 By-Products
- 09 Environmental Aspects
- 06 Industrial and Commercial Use
- 04 Marketing and Economics
- 01 Production
- 08 Properties
- 05 Safety
- 02 Storage
- 03 Transport

44 INSTRUMENTATION
- 03 Miscellaneous Instruments
- 02 Radiation Effects on Instrument Components, Instruments, or Electronic Systems
- 01 Radiation Instrumentation
- 04 Well Logging Instrumentation

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY
- 03 Isotopic Power Supplies
- 01 Physical Isotope Separation
- 02 Radiation Sources

36 MATERIALS
- 02 Ceramics, Cermets, and Refractories
- 03 Composite Materials
- 01 Metals and Alloys
- 06 Other Materials
- 04 Polymers and Plastics

03 NATURAL GAS
- 09 Artificial Stimulation, Plowshare, etc.
- 40 Combustion
- 03 Drilling, Production, and Processing
- 08 Environmental Effects
- 02 Geology and Exploration
- 05 Health and Safety
- 06 Marketing and Economics
- 10 Policy, Legislation, and Regulation
- 04 Products and By-Products
- 30 Properties
- 01 Reserves
- 50 Storage
- 20 Transport, Pipelines, and Handling
- 07 Waste Management

05 NUCLEAR FUELS
- 06 By-Products
- 05 Enrichment
- 30 Environmental Aspects
- 02 Exploration
- 04 Feed Processing
- 07 Fuels Production and Properties
- 40 Health and Safety
- 10 Marketing and Economics
- 03 Mining
- 50 Regulations
- 01 Reserves
- 08 Spent Fuels Reprocessing
- 09 Transport and Storage
- 20 Waste Management

21 NUCLEAR POWER PLANTS
- 08 Economics
- 06 Power Reactors, Auxiliary, Mobile, Package, and Transportable
- 05 Power Reactors, Breeding
- 03 Power Reactors, Non-Breeding, Graphite Moderated
- 01 Power Reactors, Non-Breeding, Light-Water Moderated, Boiling Water Cooled
- 02 Power Reactors, Non-Breeding, Light-Water Moderated, Non-Boiling Water Cooled
- 04 Power Reactors, Non-Breeding, Otherwise Moderated or Unmoderated
- 09 Process Heat Reactors
- 07 Regulation and Licensing

22 NUCLEAR REACTOR TECHNOLOGY
- 02 Components and Accessories
- 04 Control Systems
- 05 Environmental Aspects
- 03 Fuel Elements
- 07 Plutonium and Isotope Production Reactors
- 08 Propulsion Reactors
- 09 Reactor Safety
- 06 Research, Test, and Experimental Reactors
- 01 Theory and Calculation

04 OIL SHALES AND TAR SANDS
- 06 Direct Uses and By-Products
- 03 Drilling, Fracturing, and Mining
- 10 Environmental Aspects
- 07 Health and Safety
- 08 Marketing and Economics
- 04 Oil Production, Recovery, and Refining
- 05 Properties and Composition
- 20 Regulations
- 01 Reserves and Exploration
- 02 Site Geology and Hydrology
- 09 Waste Research and Management

09 OTHER SYNTHETIC AND NATURAL FUELS
- 02 Alcohol Fuels
- 06 Gaseous Waste Fuels
- 01 Hydrocarbon Fuels
- 03 Inorganic Hydrogen Compound Fuels
- 05 Liquid Waste Fuels
- 04 Solid Waste Fuels

43 PARTICLE ACCELERATORS
- 03 Auxiliaries and Components
- 02 Beam Dynamics, Field Calculations, and Ion Optics
- 01 Design, Development, and Operation
- 04 Storage Rings

02 PETROLEUM
- 50 Combustion
- 03 Drilling and Production
- 09 Environmental Aspects
- 02 Geology and Exploration
- 06 Health and Safety
- 07 Marketing and Economics
- 10 Policy, Legislation, and Regulation
- 04 Processing
- 05 Products and By-Products
- 30 Properties
- 01 Reserves
- 40 Storage
- 20 Transport, Pipelines, and Handling
- 08 Waste Management

64 PHYSICS I
- 01 Astrophysics and Cosmology
- 02 Atmospheric Physics
- 03 Atomic, Molecular, and Chemical Physics
- 04 Fluid Physics
- 50 High Energy Physics

65 PHYSICS II
- 90 Communication, Education, History, and Philosophy
- 80 Mathematical Physics
- 50 Medical Physics
- 10 Nuclear Physics
- 40 Radiation and Shielding Physics
- 60 Solid State Physics
- 70 Theoretical Physics

14 SOLAR ENERGY
- 03 Economics
- 04 Environmental, Legal, and Institutional Aspects
- 20 Heat Storage
- 08 Ocean Thermal Gradient Power Plants
- 06 Photovoltaic Power Plants
- 01 Resources and Availability
- 10 Solar Collectors and Concentrators
- 05 Solar Energy Conversion
- 09 Solar Radiation Utilization
- 07 Solar Thermal Power Plants

16 TIDAL AND WAVE POWER
- 04 Economics
- 05 Environmental Aspects
- 03 Regulations
- 07 Tidal Power Plants
- 08 Wave Energy Converters

17 WIND ENERGY
- 01 Availability (Climatology)
- 04 Economics
- 05 Environmental Aspects
- 03 Regulations
- 06 Wind Energy Engineering

CORPORATE AUTHOR INDEX

PERSONAL AUTHOR INDEX

SUBJECT INDEX

CONTRACT NUMBER INDEX

REPORT NUMBER INDEX

ORDER NUMBER CORRELATION

ENERGY RESEARCH ABSTRACTS

01 COAL AND COAL PRODUCTS

REFER ALSO TO CITATION(S) 01000050094

49328 (FE—1765-6) High temperature gas turbine engine component materials testing program. Monthly technical progress report No. 5, November 1-29, 1975. Kaplan, S.M. (General Electric Co., Schenectady, NY (USA). Gas Turbine Div.). 14 Dec 1975. 22p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017297.

Work continued to slip this month in those Subtasks that are directly affected by the lack of the coal-derived fuel oil (COED) fuel needed for initial testing. The limited amount of COED fuel to be made available, the need to resolve logistics for its delivery and the need to develop a synthetic COED fuel for the balance of initial testing and for confirmation testing have combined to create delays in the initial test program, which would otherwise have been initiated on October 20. As a result of the lack of - and/or delays involving - the above information/data requested from ERDA, the new start date of the initial COED testing appears to be late December. (This delayed start in initial testing, work scheduled to start in January in other subtasks on the basis of having initial COED fuel test results available, will have to be deferred.) Other work is continuing on schedule. The selection of materials to be tested, identification of coal feedstocks to be used, selection of a specific COED fuel to be used, and preparations for initial COED fuel testing have all been completed on schedule. Preparations for the initial low-Btu gas tests at ERDA/MERC and also, for the screening tests are proceeding in accordance with schedule. The absence of initial COED testing results needed to establish test conditions for the screening tests, however, may cause their initiation to be deferred.

0104 Processing

REFER ALSO TO CITATION(S) 01040049378, 49386, 49387, 49387, 49388, 49388, 49402, 49404, 49405, 49431, 50299

49329 (ANL/FE—83-23) State-of-the-art review of acoustic techniques for application to the nondestructive evaluation of refractory concrete for coal gasification. Claytor, T.N.; Ellingson, W.A. (Argonne National Lab., IL (USA)). Apr 1984. Contract W-31-109-ENG-38. 49p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85000778.

Acoustic methods provide a promising approach to measuring the thickness and quality of concrete structures that are accessible from only one side, such as refractory linings of coal gasifier vessels. This report discusses the theoretical and practical factors that must be taken into account when designing acoustic systems for this purpose, and gives a critical review of the systems that have been developed to date. Recommendations for the development of more effective acoustic systems are also presented.

49330 (DOE/ER/70262—T1) Studies relevant to the catalytic activation of carbon monoxide: the water gas shift reaction and related processes. Technical progress report, December 1, 1983-November 30, 1984. Ford, P.C. (California Univ., Santa Barbara (USA). Dept. of Chemistry). 1984. Contract AT03-76ER70262. 32p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85000207.

Proposed are investigations related to the catalytic activation of carbon monoxide. These studies will be concerned with the design of catalysts for the water gas shift reaction and related processes such as the hydroformylation of olefins by homogeneous solution phase systems as well as by selected metal catalysts heterogenized by complexation to functionalized polymers. Also under investigation will be quantitative mechanistic aspects of reactions considered key to probable catalyst cycles. These are principally concerned with the fundamental chemistry of metal carbonyl and metal carbonyl hydride complexes including acid/base properties, reductive elimination, substitution and cluster fragmentation reactions and the nucleophilic activation of metal coordinated carbonyls toward reaction with water or dihydrogen. The goal of these studies is to provide chemical guidelines for the molecular design of new and more efficient catalysts for the utilization of carbonaceous materials such as coal for the production of fuels and other organic chemicals. 70 references.

49331 (DOE/FE/60181—1642, pp 2.1-2.30) Gasification wastewater treatment and reuse. Hendrikson, J.G.; Mayer, G.G. Aug 1984. NTIS, PC A12/MF A01. File Number TI84017327.

In Low-rank coal research. Quarterly technical progress report, April-June 1984.

Results from the Phase II test showed that aqueous gasifier effluent treated by solvent extraction, steam stripping, AS processing, GAC adsorption, and multimedia filtration was not suitable as feed to a cooling tower operated at 10 cycles of concentration. This water was high corrosive to carbon steel, with corrosion rates of 19 to 65 mpy measured during this test. This water caused severe fouling of carbon steel, resulting in large pressure drop increases and decreases in heat transfer coefficients for carbon steel heat exchanger tubes. These results indicate that for this water to be used successfully as makeup to a cooling tower, the addition of chemicals for the control of corrosion and the associated fouling will be necessary, or substitution of stainless steel or some other corrosion resistant material for all carbon steel will be required. This water did not appear to support any substantial level of biological activity. Exhaust air from the tower was free from organics, but a substantial amount of ammonia was stripped from in the tower (65% of the influent quantities). Adsorption isotherm studies have been completed for the biologically treated and dual-media filtered SGL to determine the feasibility of using GAC to adsorb nonbiodegradable substances, such as hydantoins. A batch kinetic experiment was performed to determine the equilibrium time. 14 figures and 18 tables.

49332 (DOE/FE/60181—1642, pp 3.1-3.8) Hydrogen production from low-rank coals. Ellman, R.C. Aug 1984. NTIS, PC A12/MF A01. File Number TI84017327.

In Low-rank coal research. Quarterly technical progress report, April-June 1984.

The goal of the Hydrogen Production project is to establish the feasibility of utilizing low-rank coal gasification to produce hydrogen. Initial test work will be performed in a large TGA-type apparatus designed to operate at elevated pressure and temperature. Survey of the literature relating to catalytic steam gasification of coal is a continuing effort by which project direction can be facilitated and candidate catalysts for testing are selected. A bibliography of 155 references pertaining to the catalysis of the water-gas shift reaction has been completed. A total of 128 references on the catalytic gasification of coal, coal char, and model carbons such as graphite and activated carbon, have been reviewed. These studies include gasification in hydrogen, carbon dioxide, and water vapor atmospheres with indigenous mineral matter, alkali, alkaline earth, and transition metals and their salts. A particular objective is to identify a catalyst or type of catalyst which may be effective in both the carbon conversion reaction and in the associated water-gas shift reaction. A variety of coal and carbon sources have been tested. Low-rank coals, whether tested with their natural mineral matter or in the demineralized form, demonstrate reactivities that are many times greater than other coals. In addition, the same coal

may exhibit different reactivities, depending upon pyrolysis conditions. In a commercial process, use of a catalyst has limitations of cost effectiveness, which includes considerations such as technique and method of application, its recovery for further use, and its amenability to reactivation. Although potassium carbonate is indicated to be effective, calcium carbonate is less expensive. The naturally occurring alkaline constituents of low-rank coal ash suggest also that recycled ash is a low-cost, disposable catalyst that must be considered. 5 figures, 1 table.

49333 (DOE/FE/60181—1642, pp 5.1-5.26) **Low-rank coal liquefaction.** Rindt, J.R.; Owens, T.C.; Farnum, S.A. Aug 1984. NTIS, PC A12/MF A01. File Number TI84017327.

In Low-rank coal research. Quarterly technical progress report, April-June 1984.

Development of an improved quantitative gas chromatographic method for the analysis of lignite liquefaction distillate fractions has continued. The internal standard method of quantitation was chosen with 2-methylpentadecane being selected as the internal standard for hydrocarbon fractions and phenyl ether being selected as the internal standard for the phenolic fraction resulting from the solvent extraction. A 3-level calibration bracketing the sample size is used. Appropriate samples from the silica gel adsorption columns and from the solvent extraction are diluted in the range of 200 to 1000 ppM and chromatographed under the conditions summarized. Instruments used include a Hewlett-Packard model 5880A gas chromatograph and a Varian model 5880A gas chromatograph, both accommodating an autosampler, cryogenic cooling, and multilevel temperature programming. The gas chromatographic scheme developed allows for excellent resolution of 86 hydrocarbons and 22 phenols. Identification of sample components is done by retention indices and confirmation is by gas chromatography/mass spectroscopy. Work is continuing to develop methods for better resolution of phenols and the quantitation of nitrogen- and sulfur-containing compounds. 6 figures, 9 tables.

49334 (DOE/FE/60181—1642, pp 17.1-17.13) **Supercritical solvent extraction.** Dollimore, J.; Swanson, M.L.; Olson, E.S.; Farnum, S.A. Aug 1984. NTIS, PC A12/MF A01. File Number TI84017327.

In Low-rank coal research. Quarterly technical progress report, April-June 1984.

Previous work performed by other investigators has demonstrated the ability of supercritical CO_2 to remove organic impurities from spent activated carbon. Several advantages of supercritical fluid regeneration include: (1) supercritical CO_2 is a good solvent for several organics, (2) dissolved organics can be easily separated from the CO_2, (3) the activated carbon is spared the thermal degradation which occurs with thermally regenerating the activated carbon, and (4) CO_2 is a relatively cheap nonhazardous and nontoxic solvent. A particular problem encountered at the University of North Dakota Energy Research Center (UNDERC) has been the removal of 5,5-dimethylhydantoin and 5-methyl-5-ethylhydantoin from the wastewaters generated from UNDERC's slagging fixed-bed gasifier. Adsorption onto granulated activated carbon has been the only method found to date that will effectively remove these hydantoins from the wastewater. A major expense involved in using activated carbon as a wastewater treatment method is the cost incurred in replacing the activated carbon burned off when the activated carbon is thermally regenerated. While regeneration of the activated carbon using methanol to extract the hydantoin has been shown to be effective, it was suggested that employing supercritical CO_2 to regenerate the spent GAC might be another way to reduce regeneration costs. 5 references, 2 figures, 8 tables.

49335 (DOE/FE/60181—1642, pp 18.1-18.12) **Pyrolysis and devolatilization.** Schelkoph, G.M.; Hefta, R.S. Aug 1984. NTIS, PC A12/MF A01. File Number TI84017327.

In Low-rank coal research. Quarterly technical progress report, April-June 1984.

Considerable information may be acquired by analysis of data obtained from ultimate and proximate analyses of the pyrolyzed coals. Figure 18-5 shows the mass fraction of coal and hydrogen, carbon and oxygen remaining on an maf basis upon pyrolysis at a 5°C/min heating rate and a subsequent 30 minute isothermal pyrolysis at the final temperature. By 850°C, more than 90% of the maf hydrogen and oxygen has been evolved but only slightly less than 25% of the maf original carbon has been released. The maf coal mass apparently stabilizes after 700°C, indicating that further hydrogen and oxygen elemental release have little effect on the total mass since hydrogen and oxygen have been reduced to small fractions of the char. Figure 18-6 shows the effect of maintaining the pyrolysis temperature at 850°C for 30 minutes compared to slowly cooling the sample. The isothermal period had no appreciable effect on the oxygen and carbon quantities remaining but greatly affected the hydrogen content in the char as it was reduced by 66% during the isothermal program. Evidently, at these high temperatures, hydrogen elemental release is strongly a function of time while oxygen and carbon elemental release are mainly a function of temperature. 12 figures, 2 tables.

49336 (DOE/METC—84-6, pp 4-20) **Overview to DOE/Fossil Energy's gas stream contaminant control program.** Moore, W.E. (USDOE, Washington, DC). Dec 1983. NTIS, PC A21/MF A01. File Number DE84000216. (CONF-8305112—).

From 3. annual contractors' meeting on contaminant control in hot coal derived gas streams; Washington, PA, USA (24 May 1983).

An overview to DOE/Fossil Energy's gas stream cleanup program is provided. This overview presents the overall structure for the program which consists of three program elements: Turbine Cleanup Systems, Molten Carbonate Fuel Cell Cleanup and Process Modification Technology. Overall program goals for each of the three program elements are provided. Additionally, the advantages for contaminant removal at high temperature and system pressure are presented including: cost of electricity and capital cost advantages as well as improvement in overall thermal efficiencies. These improvements for HTHP cleanup are as determined by a recent in-house technology assessment by DOE/Fossil Energy/Headquarters. The key developmental issues that are being addressed by R & D projects are described with overall conclusions drawn that these issues appear to be solvable and are well worth resolution considering the overall improvements obtainable with high temperature/high pressure gas stream cleanup systems. 9 references, 8 figures.

49337 (DOE/METC—84-6, pp 21-41) **Status and overview of surface coal gasification.** Strickland, L.D.; Gillmore, D.W. Dec 1983. NTIS, PC A21/MF A01. File Number DE84000216. (CONF-8305112—).

From 3. annual contractors' meeting on contaminant control in hot coal derived gas streams; Washington, PA, USA (24 May 1983).

The rapidly changing energy picture in the USA has resulted in decreasing commercial interest in synfuels from coal and a new PDU by Mountain Fuel Resources at Salt Lake City, Utah, is currently being placed in operation. Several of these facilities may be retained for testing equipment, components, instrumentation, and materials and for environmental evaluations. There are over 30 commercial gasifiers, mostly of the fixed-bed, atmospheric type, currently in operation or in stand-by status in the USA. Four modern gasification plants, i.e., Great Plains, Cool Water, Kilngas, and Tennessee Eastman, are under construction and a fifth plant is operating at TVA. Nineteen feasibility studies to encourage industry to investigate a variety of processes and locations have been completed without any private sector decisions to proceed to commercialization because of financial constraints. However, several of these and others have been submitted to the Synthetic Fuels Corporation (SFC) for financial assistance. Currently, 10 coal to gas and coal to indirect liquids projects are being considered by SFC. DOE's Fossil Energy program is now emphasizing the establishment of an adequate scientific and engineering data base to encourage private sector initiatives in synfuels from coal. The government's role is longer range, high-risk, and potentially high-payoff research and development through proof of concept at the smallest scale necessary. It is apparent at this time that a large scientific, engineering, and environmental data base will be captured, and data gaps and R & D needs will be clearly identified for a continuing synfuels from coal program. 13 figures.

49338 (DOE/METC—84-6, pp 87-119) **Metal/metal oxides as high temperature desulfurization sorbents.** Jalan, V.; Desai, M.; Brooks, C.; Waterhouse, R. (Giner, Inc., Waltham, MA). Dec 1983. NTIS, PC A21/MF A01. File Number DE84000216. (CONF-8305112—). Contract AC21-81MC16021.

From 3. annual contractors' meeting on contaminant control in hot coal derived gas streams; Washington, PA, USA (24 May 1983).

This research is a continuation of the investigation of a high temperature regenerable desulfurization process capable of reducing the sulfur content in coal gases from 200 ppM to 1 ppM. The overall objective is the integration of a coal gasifier with a molten carbonate fuel cell, which requires that the sulfur content be below 1 ppM. Commercially available low temperature processes incur an excessive energy penalty. Our recent studies with packed bed and fluidized bed reactors have demonstrated that a CuO/ZnO mixed oxide sorbent is regenerable and capable of lowering the sulfur content (as H_2S and COS) from 200 ppM in simulated hot coal-derived gases to below 1 ppM level at 600 to 650°C. Previous studies at Giner, Inc. had identified Cu and CuO/ZnO as attractive sorbents and the use of steam-air for efficient regeneration of the spent sorbent. Further optimization has established highly dispersed CuO on zeolite, highly dispersed [CuO + ZnO] on zeolite, and a coprecipitated CuO/ZnO as the three most promising sorbents. Based on engineering considerations, CuO/ZnO was selected for further study. A structural reorganization mechanism, unique to mixed oxides, was identified: the creation of relatively fine crystallites of the sulfided components (Cu_2S and ZnS) counteract the 26% water vapor in simulated coal gases show that sulfur levels below 1 ppM can be achieved in the temperature range of 500° to 650°C. The ability of CuO/ZnO to remove COS, CS_2, and mercaptans at these conditions was also demonstrated. 12 references, 12 figures, 9 tables.

49339 (DOE/METC—84-6, pp 121-143) **Hot-gas chloride cleanup for molten carbonate fuel cells.** Ham, D.; Gelb, A.; Lord, G.; Simons, G. (Physical Sciences, Inc., Andover, MA). Dec 1983. NTIS, PC A21/MF A01. File Number DE84000216. (CONF-8305112—).

From 3. annual contractors' meeting on contaminant control in hot coal derived gas streams; Washington, PA, USA (24 May 1983).

The objective of the chloride cleanup program was to screen and test potential hot gas chloride sorbents for possible use as part of a hot gas cleanup process in a combined molten carbonate fuel cells (MCFC)/ coal gasifier power plant. An effective sorbent can provide one stage of two or three fixed absorption beds between the gasifier and the MCFC for cleanup of sulfide species (primarily H_2S and COS), chlorides (essentially HCl) and trace contaminants. The first phase of our investigation of potential chloride sorbents was an evaluation and screening of all candidate materials. Results of this screening show that alkali carbonates are the only substances that can reduce the total chloride concentration below ppMV levels at temperatures up to 800 K and that above 800 K the chloride concentration cannot be reduced below ppMV levels at equilibrium. Potentially useful minerals were tested by reacting them in a hot flow reactor with HCl contained in simulated coal gasifier effluent and deducing reaction rates as a function of sorbent capacity. These tests indicate that the naturally occurring mineral Shortite is the leading candidate for a hot gas HCl cleanup sorbent. Thermochemical estimates of bed capacities and melting temperatures were made for Shortite saturated with chloride to show that no problems should be encountered with bed melting over the temperature and composition ranges anticipated for hot gas cleanup. Details of our HCl absorption experiments and analysis of the results of these experiments in terms of a model for reaction of porous sorbents and results of our calculations that show that melting of the sorbent bed does not limit chloride utilization are presented. 5 references, 10 figures, 2 tables.

49340 (DOE/METC—84-6, pp 145-171) **Zinc ferrite hydrogen sulfide absorbent.** Grindley, T.; Steinfeld, G. (Morgantown Energy Tech. Center, Morgantown, WV; Science Applications, Inc., Morgantown, WV). Dec 1983. NTIS, PC A21/MF A01. File Number DE84000216. (CONF-8305112—).

From 3. annual contractors' meeting on contaminant control in hot coal derived gas streams; Washington, PA, USA (24 May 1983).

During last year, development and testing at high-temperature, coal-gas desulfurization sorbents for molten carbonate fuel cell application have been continued, with particular emphasis on a zinc ferrite sorbent which had previously demonstrated superior properties of high sulfur loading and regenerability. Laboratory-scale tests in the 2-inch diameter fixed-bed reactor have included absorption/regeneration cycles at various gas conditions of hydrogen sulfide and steam content, and space velocity. The data generated are being used to validate a computer simulation of a fixed-bed, high-temperature, desulfurization process. An attempt was made to improve the sorbent's sulfur removal ability by addition of vanadium oxide. This was not successful. Zinc ferrite sorbents with a deficiency of zinc oxide were found to perform satisfactorily. In separate experiments by Research Triangle Institute, a simulated coal gas containing tars and hydrogen chloride in addition to hydrogen sulfide was passed through a fixed bed of zinc ferrite at 550°, 650°, and 750°C. Phenol and toluene were deoxygenated and dealkylated, respectively, to benzene. Modest amounts of carbon were deposited in the sorbent. Significant amounts of hydrogen chloride were not absorbed. For comparison with the zinc ferrite, an experimental zinc-oxide containing sorbent from Institut Francais du Petrole (IFP), designed for gas-turbine application, was also tested. The IFP sorbent, after regeneration, contained substantial amounts of sulfate which decomposed during subsequent absorption, liberating sulfur oxides. A larger skid-mounted, bench-scale, hot gas desulfurization unit has been constructed and installed in a side stream of the METC 24 t/d fixed-bed gasifier to acquire process data when operating with real coal gas. 9 references, 8 figures, 7 tables.

49341 (DOE/METC—84-6, pp 173-193) **Development of a hot gas cleanup system for integrated coal gasification/molten carbonate fuel cell power plants.** Lyke, S.E.; Sealock, L.J. Jr. (Battelle Pacific Northwest Labs., Richland, WA). Dec 1983. NTIS, PC A21/MF A01. File Number DE84000216. (CONF-8305112—).

From 3. annual contractors' meeting on contaminant control in hot coal derived gas streams; Washington, PA, USA (24 May 1983).

Hydrogen sulfide (H_2S), carbonyl sulfide (COS) and hydrogen chloride (HCl) must be removed between the high pressure coal gasifier and molten carbonate fuel cell (MCFC) of an advanced concept power plant. For greatest efficiency, removal should be performed in a single step at or above the fuel cell operating temperature. A regeneration gas must be produced from which elemental sulfur can be recovered. Battelle, Pacific Northwest Laboratories (PNL) has developed through the bench scale a process to remove H_2S and COS from hot fuel gas with a solution of molten Li, Na, K and Ca carbonates supported on a solid substrate. The current effort is to extend that process for use in integrated coal gasification/molten carbonate fuel cell power plants. Specific goals are to select a salt composition to give high sulfur loading under CO_2 and H_2O back pressures, demonstrate removal of HCl as well as H_2S/COS, develop a regeneration scheme to allow continued removal to less than one part per million while producing an H_2S-rich stream for sulfur recovery, and obtain necessary data for evaluation and scale-up of the process. A laboratory system has been constructed to study absorption and regeneration in supported or unsupported molten salts with simulated fuel gases at pressures and temperatures up to 15 atm and 800°C. Equilibrium experiments with unsupported salt are in progress. A pressure-capable laboratory system was constructed because salt composition and performance are sensitive to the partial pressures of the various fuel gas components. This paper presents the background, approach, and initial results of the experimental program. 6 references, 3 figures, 3 tables.

49342 (DOE/METC—84-6, pp 195-216) **H_2S removal using mixed metal oxides and HCl removal using molten alkali carbonates.** Anderson, G.L.; Berry, F.O.; St. John, M. (Inst. of Gas Tech., Chicago, IL). Dec 1983. NTIS, PC A21/MF A01. File Number TI84000216. (CONF-8305112—).

From 3. annual contractors' meeting on contaminant control in hot coal derived gas streams; Washington, PA, USA (24 May 1983).

The availability of an energy-efficient and cost-effective high-temperature gas cleanup scheme is expected to make a significant contribution toward reducing the cost of electricity from coal gasification/molten carbonate fuel cell (MCFC) power plants. Engineering studies suggest that a high-temperature gas cleanup scheme might reduce the installed cost of a plant by as much as $48/kW and improve the thermal efficiency by about 1%. This reduction in installed cost and increase in thermal efficiency are primarily the result of reductions in fuel gas heat exchange requirements and the elimination of a gas quenching operation needed to utilize available low-temperature gas cleanup processes. The components in coal-derived fuel gases that are currently considered the most deleterious to the MCFC and that must be removed from the fuel gas are reduced-sulfur-containing compounds such as hydrogen sulfide (H_2S) and halogen-containing compounds such as hydrogen chloride (HCl). Although the long-term impact of these components as MCFC performance is currently the subject of ongoing work, it is anticipated that an acceptable level for these compounds in the fuel gas will be somewhere between 0.1 and 10 ppM. The Institute of Gas Technology (IGT) is currently conducting a research program in support of the development of separate high-temperature processes for the removal of reduced-sulfur-containing compounds from coal-derived fuel gas. The proposed processes, which are based upon previous work conducted at IGT are described below along with relevant progress. 8 references, 9 figures, 5 tables.

49343 (DOE/METC—84-6, pp 311-338) **High-temperature removal of alkali vapors in hot-gas cleaning systems.** Mulik, P.R.; Alvin, M.A.; Bachovchin, D.M. (Westinghouse Electric Corp., Pittsburgh, PA). Dec 1983. NTIS, PC A21/MF A01. File Number DE84000216. (CONF-8305112—).

From 3. annual contractors' meeting on contaminant control in hot coal derived gas streams; Washington, PA, USA (24 May 1983).

The purpose of this program is to ascertain the feasibility of using aluminosilicate-based getters for controlling alkali in pressurized, hot-gas cleaning systems. To this end, we have carried out experimental and analytical investigations, system designs, and cost estimates. The overall objective of the program is to develop a comprehensive plan for evaluating a scaled-up version of the gettering process as a unit operation or as an integral part of a particulate removal device. The paper describes work completed under this project on thermodynamic projections, together with our efforts over the past 15 months on getter selection and qualification and on system performance projections. In summary, work completed on the thermodynamic projections includes a data base update, alkali phase diagram development, and gasification process projections. Getter selection and qualification efforts involved kinetic studies using both our bench-scale and thermogravimetric analysis (TGA) units. The bench-scale studies involved a series of runs with the leading candidate getter - emathlite - in an inert carrier gas with water vapor, an inert carrier gas with salt (NaCl) and water vapor, and a simulated fuel gas containing water vapor and NaCl. TGA studies focused on further evaluation of six candidate getters selected in the bench-scale studies, together with a detailed evaluation of the leading candidate getter. Finally, system performance projections entailed using the available kinetic data on emathlite to develop a model and to estimate the size requirements for a full-scale unit. On the basis of available data and modeling efforts, we concluded that long contact times must be provided for emathlite to getter effectively, so deep packed beds are the preferred contacting device. 8 references, 13 figures, 6 tables.

49344 (DOE/METC—84-6, pp 437-440) **Design and development of a high temperature particle separator for particle control in coal gasification plants.** Linhardt, H.D. (Linhardt & Associates, Inc., Newport Beach, CA). Dec 1983. NTIS, PC A21/MF A01. File Number DE84000216. (CONF-8305112—).

From 3. annual contractors' meeting on contaminant control in hot coal derived gas streams; Washington, PA, USA (24 May 1983).

This paper summarizes the results of the High Velocity Particle Separator Research and Development program performed by Linhardt & Associates, Inc., (L & A) under Contract EF-77C-01-2709 and more recently, Contract DE-AC01-81FE05120. The overall objective of the program was the design, development and test evaluation of a cost effective high velocity particle separator suitable for high temperature and high pressure coal conversion and utilization applications removing particulates as small as 2 micrometers with high collection efficiency. 1 figure.

49345 (DOE/OR/03054—51) **Assessment of feedability of Kerr-McGee ash concentrate.** Moujaes, S.F. (Jenike and Johanson, Inc., North Billerica, MA (USA); International Coal Refining Co., Allentown, PA (USA)). Sep 1983. Contract AC05-78OR03054. 71p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85001489.

Tests were performed to determine the feasibility of conveying Kerr-McGee ash concentrate from storage bins through the screw feeder to the Gesellschaft feur Kohle-Technologie (GKT) gasifier. A study comparing flow characteristics of coal, for which the GKT system was designed, and Kerr-McGee ash concentrate (KMAC) showed that properties were similar, although KMAC had a lower bulk density. A computer simulation based on these properties was then applied to the conveying system. Results showed that KMAC flow will be unstable for almost all the KMAC samples studied when the gradients in gas and solid contact pressure in the convergent outlet of the screw feeder are very large, and when the scale factor is relatively high, i.e., greater than the critical value of 460. However, use of larger bins coupled with operation of the screw feeder at a slower rpm should result in stable operation and satisfy the flow requirements of the process design. GKT concluded that while improvements can be made to boost throughput and increase stability, serious consideration should be given to an alternate pneumatic conveying system to the gasifier. 3 references, 4 figures, 4 tables.

49346 (DOE/OR/03054—113) **Impact of hydrogen partial pressure on coal liquefaction. Final technical report.** Kang, D.; Hoover, D.S.; Schweighardt, F.K. (Air Products and Chemicals, Inc., Allentown, PA (USA)). Jun 1984. Contract AC05-78OR03054. 103p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85001488.

This program was conducted to determine the effects of hydrogen partial pressure on the SRC-I direct coal liquefaction process and SRC-I Demonstration Plant design. A native solvent was produced in quantity and slurried with Kentucky # 9 Mulford coal in a series of coal liquefaction runs under varying hydrogen gas rates, temperatures, residence times, and hydrogen partial pressures. The results showed that hydrogen partial pressure significantly affected product distribution; the magnitude of the effect was comparable to changes in temperature and residence time. Also, the impact of hydrogen partial pressure was enhanced by increases in both temperature and residence time. Operating at low hydrogen partial pressure did not show any apparent advantage; it reduced coal conversion, reduced oil yield, and had a detrimental effect on the yield distribution of other products. An increase in hydrogen partial pressure had the following effects: increased coal conversion; increased conversion of asphaltenes and preasphaltenes to lighter products; significantly increased the oil yield; increased light gas yields; decreased sulfur content in the SRC; increased hydrogen content of the recycle solvent; and increased hydrogen consumption. This study strongly suggests that further studies should be conducted to optimize the effects of hydrogen partial pressure on the process, both within and, preferably, beyond the constraints of the current basic SRC-I design, considering the major impact of this variable on the process. 10 references, 37 figures, 10 tables.

49347 (DOE/OR/03054—T11-Suppl.) **SRC-1: coal liquefaction demonstration plant. Project Baseline assessment report supplement.** (International Coal Refining Co., Allentown, PA (USA); Burns and Roe/Humphreys-Glasgow Synthetic Fuels, Inc., Oradell, NJ (USA)). Sep 1984. Contract AC05-78OR03054. 155p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE85001446.

ICRC issued a Revised Baseline for the SRC-I Demonstration Project in order to incorporate the results of these research activities and the changes in the design that had occurred since FY82.

The Revised Baseline, prepared by ICRC, provides the necessary information for any future government or commercial decisions relating to the design, construction and operation of an SRC-I-type coal liquefaction facility. No further activities to complete the design of the demonstration plant, or to proceed with construction are planned by DOE. The Project Baseline is an ICRC-documented reference for controlling any future project work and cost. The original Baseline was issued in March 1982; this summary document is available from National Technical Information Service (NTIS) as document number DOE/ORO/030540-T13. The Revised Baseline (dated April 1984) is available as document numbers DOE/OR/03054-T14 and T16. Supporting documentation, in the main concerned with research activities undertaken in support of the design, is also available from NTIS as DOE/OR/03054-T1 through T10 and DOE/OR/03054-1 through 125. The Baseline itself is made up of a documented design configuration, a documented estimate, in First Quarter Fiscal Year 1982 Dollars (1QFY82$), and a detailed schedule of the activities required to complete the project as of 3QFY82. The Baseline design is embodied in the 26 process design packages and other support documentation identified in the Baseline, as well as preliminary engineering flow diagrams prepared for all of the major process areas of the plant. All elements of the Project Baseline were developed within the constraints of the project criteria.

49348 **(DOE/OR/03054—T22) Calciner unit SRC-I Coal Refinery, Newman, Kentucky: design baseline. Revision 1.** Lummus, C.E. (C-E Lummus, Bloomfield, NJ (USA)). Sep 1982. Contract AC05-78OR03054. 236p. NTIS, PC A11/MF A01; 1; GPO Dep. File Number DE85000465.

The coke calcination process area, green coke from the Delayed Coker unit is calcined to produce anode grade coke product. The product coke is transferred to storage facilities before shipment. Waste gases produced are used to generate 900 psig superheated stream and then are treated by a Venturi Scrubber before being discharged to the atmosphere. The process unit can be divided into the following sections: Coke Calcining, Waste Heat Boiler, Flue Gas Scrubber; and Handling and Storage of Calcined Coke.

49349 **(DOE/OR/03054—T26-Vol.2) Design baseline: 6000 tpd SRC-I Demonstration Plant. Volume 2 (revised).** (Catalytic, Inc., Philadelphia, PA (USA)). 22 Oct 1982. Contract AC05-78OR03054. 122p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85001467.

Volume 2 consists of a detailed description of the SRC-I process (23 pages), a description of process control and the philosophy used and flowsheet drawings. (LTN)

49350 **(DOE/OR/03054—T26-Vol.4) Design baseline: 6000 tpd SRC-1 Demonstration Plant. Volume 4 (revised).** (Catalytic, Inc., Philadelphia, PA (USA)). 22 Oct 1982. Contract AC05-78OR03054. 308p. NTIS, PC A14/MF A01; 1; GPO Dep. File Number DE85001465.

Volume 4 consists of a list of equipment for the SRC-1 Demonstration Plant and specifications for each item. (LTN)

49351 **(DOE/OR/03054—T26-Vol.5) Design baseline: 6000 tpd SRC-1 Demonstration Plant. Volume 5 (revised).** (Catalytic, Inc., Philadelphia, PA (USA)). 22 Oct 1982. Contract AC05-78OR03054. 336p. NTIS, PC A15/MF A01; 1; GPO Dep. File Number DE85001464.

Volume 5 continues the specification sheets, which began in Vol. 4, and then lists the materials of construction specified for the specific equipments. Finally, it includes a piping list giving the two equipments each pipe connects, the material specified and the maximum corrosion rate allowed. (LTN)

49352 **(DOE/PC/40784—T4) Dependence of liquefaction behavior on coal characteristics. Part VI. Relationship of liquefaction behavior of a set of high sulfur coals to chemical structural characteristics. Final technical report, March 1981 to February 1984 .** Neill, P.H.; Given, P.H. (Pennsylvania State Univ., University Park (USA)). Sep 1984. Contract AC22-81PC40784. 232p. NTIS, PC A11/MF A01; 1; GPO Dep. File Number DE85000216.

The initial aim of this research was to use empirical mathematical relationships to formulate a better understanding of the processes involved in the liquefaction of a set of medium rank high sulfur coals. In all, just over 50 structural parameters and yields of product classes were determined. In order to gain a more complete understanding of the empirical relationships between the various properties, a number of relatively complex statistical procedures and tests were applied to the data, mostly selected from the field of multivariate analysis. These can be broken down into two groups. The first group included grouping techniques such as non-linear mapping, hierarchical and tree clustering, and linear discriminant analyses. These techniques were utilized in determining if more than one statistical population was present in the data set; it was concluded that there was not. The second group of techniques included factor analysis and stepwise multivariate linear regressions. Linear discriminant analyses were able to show that five distinct groups of coals were represented in the data set. However only seven of the properties seemed to follow this trend. The chemical property that appeared to follow the trend most closely was the aromaticity, where a series of five parallel straight lines was observed for a plot of f/sub a/ versus carbon content. The factor patterns for each of the product classes indicated that although each of the individual product classes tended to load on factors defined by specific chemical properties, the yields of the broader product classes, such as total conversion to liquids + gases and conversion to asphaltenes, tended to load largely on factors defined by rank. The variance explained and the communalities tended to be relatively low. Evidently important sources of variance have still to be found.

49353 **(DOE/PC/40810—10) Synthesis of oligomeric models of coal derived materials for use with GPC calibration. Quarterly report, June 1984-September 1984.** Baltisberger, R.J.; Jones, M.B. (North Dakota Univ., Grand Forks (USA)). Oct 1984. Contract FG22-81PC40810. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000705.

The purpose of this study was to develop a set of GPC calibration standards for asphaltene and preasphaltene analyses. A series of oligo(aryl ether) (1) and oligo(arylmethylenes) (2) from 170 to 580 g/mole were prepared via modified Ullmann-type reactions (ethers) and condensation of an aryl lithium derivative with an aryl carboxaldehyde, followed by reduction of the resulting carbonol (methylenes). These compounds were examined as molecular weight calibration standards for GPC analysis. A nearly linear plot was found to exist between the logarithm of molecular weight times mol fraction hydrogen versus retention volume with THF as the solvent. Further this plot was coincident with commercial polystyrene standards (600 to 2000 g/mol) and with the majority of our lignite-derived asphaltenes and preasphaltenes. GPC data have been measured for a series of acetylated solvent refined lignite (SRL) asphaltenes and preasphaltenes and model compounds. Two structural parameters, the degree of aromatic condensation (H/sub aru//C/sub ar/) and the molar hydrogen to carbon ratio (H/C), were employed to correct the molecular weight of the samples for linear molecular size. For the model compounds, H/sub aru//C/sub ar/ was more effective, whereas the SRL materials were better adjusted by H/C. The calibration standards deemed most suitable for determination of molecular weight of SRL by GPC are the SRL samples themselves.

49354 **(DOE/PC/50001—23) Short residence time coal liquefaction. Topical report, May 1978-July 1982.** (Gulf Research and Development Co., Shawnee Mission, KS (USA)). Feb 1984. Contract AC22-82PC50001. 112p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85001165.

This report is the second in a series of topical reports describing work conducted for the US Department of Energy at Gulf Oil Corporation's Merriam Coal Liquefaction Laboratory. It reviews research carried out over several years to determine the role of process variables in an SRC I type coal dissolution process. The data reported describe the effects of temperature (440 to 500°C), pressure (1000 to 3000 psig) and residence time (1 to 10 minutes) using bituminous coal (Kentucky 9/14, Indiana V, and Pittsburgh seams) in the short residence time solvent refined coal (SRC) process. All of the research was conducted using a continuous bench

scale unit. The short residence time SRC process was originally envisioned as a stand-alone process which would produce a low cost solid SRC I type product. With interest shifting toward the production of higher quality products, the short residence time SRC process can now be thought of as a minimum cost first stage of a multistaged process. 9 references, 16 figures, 23 tables.

49355 **(DOE/PC/60044—T2) New and improved dispersion and recovery techniques for slurry phase catalysis. Quarterly report, January-March, 1984.** Tarrer, A.R.; Guin, J.A.; Curtis, C.W.; Tatarchuk, B.J. (Auburn Univ., AL (USA). Coal Conversion Lab.). 1984. Contract AC22-83PC60044. 30p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85001629.

A mathematical model has been developed for predicting the effects of various parameters such as recycle rate, permanent and temporary deactivation rate constants on catalyst activity. The intent of this analysis is to evaluate the importance of the ease with which a catalyst can be regenerated and to identify important catalyst properties associated with regeneration. A reactor (hydrotreater)-regenerator system having equal catalyst inventory in each unit is used as a basis for modeling. A fixed amount of fresh catalyst supply and spent catalyst withdrawal are assumed to be applicable to the reactor. The analysis shows that a small percent increase in the permanent deactivation rate constant relative to total deactivation rate constant decreases the mean activity of the catalyst in the reactor significantly. In most cases, the mean activity of the catalyst increased with increasing recycle rate. The effect of regeneration rate constant on the catalyst activity was not significant compared to that of permanent deactivation rate constant. 13 references, 3 figures.

49356 **(DOE/PC/60047—T4) Advanced research for the characterization of hydrogen donor solvents in two-stage liquefaction. Quarterly report, April 1, 1984-June 30, 1984.** Hamshar, J.A.; Potts, J.D. (Cities Service Research and Development Co., Tulsa, OK (USA)). 1984. Contract AC22-83PC60047. 57p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85001156.

Solvent-only reactions at SCT conditions in hydrogen were explored for each of the four blended solvents, ranging from 6.1 to 8.6 wt. % hydrogen content (nominally 6.1, 7.7, 7.4, 8.6). Generally, no loss of solvent to gas was measured, but small amounts of retrograde reactions (oil to preasphaltenes, asphaltenes, insolubles) were observed at both low and high severity. Insolubles were produced in solvent A (6.1% H) and consumed in solvent D (8.6% H). Ten hydrotreating and hydrocracking catalysts have been selected and obtained from a variety of catalyst manufacturers. A matrix of eleven runs was made using the base catalyst and solvent B (7.7% H) to determine ranges of operating conditions appropriate for further catalyst testing. A series of 72 run conditions were completed at SCT conditions for coal extraction in the microautoclave, studying the effects of temperature, residence time, pressure, solvent makeup, and atmosphere. At hydrogen-deficient conditions, coal conversions were observed to decline at the highest reaction severities (i.e. 850 to 900°F), apparently due to condensation (coking) reactions. Preasphaltene and asphaltene yields are maximized at intermediate severities, and oil yields increase with severity over the range of conditions tested. Coal conversions in a nitrogen atmosphere were generally slightly less than in hydrogen, for all solvents, and at both mild and severe conditions. Coal conversions maximize at a solvent hydrogen content of approximately 7.5%. At this level of hydrogen content, solvent B (7.7% H), made by mild hydrogenation of KC-oil, out-performs solvent C (7.4% H), made by blending hydrogen-rich and hydrogen-deficient components. The performance of solvent C was, however, significantly better than that of either component by itself. 21 figures, 18 tables.

49357 **(DOE/RL/01830—T30) Development of an advanced water-gas shift conversion system. Monthly project status report No. 6, September 1-30, 1984.** Sealock, L.J. Jr.; Elliott, D.C.; Butner, R.S. (Pacific Northwest Lab., Richland, WA (USA)). 1984. Contract AC06-76RL01830. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001584.

Research in September resulted in several notable developments in the operation and design of the continuous water-gas shift reactor. Analysis of the data collected in August and early September for low temperature (250°C) operation indicated that conversion rates were even lower than expected. The probable cause of this discrepancy from earlier batch reactor experiments is thought to be related to the fact that the feed gas is introduced to the reactor at relatively low temperatures. Calculations of the feed gas temperature indicate that the gas at the point of introduction to the liquid phase is less than 50°C. While the gas is warmed as it rises through the hot catalyst solution, the overall effect is a lowering of the observed reaction rate. In addition, further studies of the water-sodium carbonate and water-sodium formate systems indicate little advantage in the use of higher-salt concentrations in an attempt to lower the solution vapor pressure. In essence, our operating pressure appears to be limited to the solution vapor pressure (at operating temperature) which is very nearly that of pure water. To counteract these limitations, a feed gas pre-heater was designed to heat the carbon monoxide to a temperature of 400 to 500°C prior to its introduction to the reactor vessel. Several experimental runs of the reactor system using aqueous potassium carbonate as a catalyst instead of aqueous sodium carbonate were completed this month. A two-fold increase in catalyst activity was noted when the potassium salt was used. The dip tube used to sparge the feed gas into the catalyst solution was also redesigned. Initial results indicate only marginal improvement in conversion with the new tube. 1 figure.

49358 **(EPRI-AP—3580) Nonintegrated two-stage coal liquefaction: the Wilsonville Advanced Coal Liquefaction R and D Facility, Wilsonville, Alabama. Final report.** (Catalytic, Inc., Wilsonville, AL (USA); Southern Co. Services, Inc., Birmingham, AL (USA)). Aug 1984. Contract AC22-76ET10154;AC22-82PC50041. 457p. NTIS, PC A20/MF A01; 1 - EPRI; GPO Dep. File Number DE85001911.

Investigation of the nonintegrated two-stage coal liquefaction (NTSL) process was initiated at the Wilsonville Advanced Coal Liquefaction R and D Facility during May 1981 when the H-Oil hydrotreating unit came successfully on-line. The primary objective of this investigation is the development of a commercially feasible method of efficient conversion of coal to more marketable liquid fuels, such as +350°F distillates and residual oils. When compared to the single-stage solvent-refined coal process (SRC-I) - combined SRC and critical solvent de-ashing (CSD) units - the NTSL product contains significantly higher yields of distillates. The additional production of distillates is accomplished, without adversely affecting the hydrogen consumption efficiency, by separating the thermal coal dissolution reactions and catalytic conversion reactions and by selective recycle of light SRC from the CSD unit to the SRC unit. This topical report presents an analysis of the NTSL process operating data from May 1981 to March 1982. In addition, some data from operating periods prior to May 1981 and after March 1982 are also included. During these periods, Kentucky 9 (Fies) coal and Illinois 6 (Burning Star) coal were processed. Commercially available cobalt-molybdenum and nickel-molybdenum hydrodesulfurizing catalysts were used to hydrotreat the thermal stage de-ashed extract (CSD unit product). The daily operating and material balance data have been used for analyses. A general discussion of run results, unit performance, product quality, selectivity, fuel oil blend studies, optimum performance projection, and process economics is presented. 14 references, 27 figures, 51 tables.

49359 **(ICTIS/TR—26) Catalytic coal gasification.** Pullen, J.R. (International Energy Agency Coal Research, London (UK)). Jun 1984. 57p. NTIS (US Sales Only), PC A04/MF A01. File Number TI84901801.

Recent literature relating to the catalytic gasification of coal is reviewed. Inorganic species effective in promoting gasification in steam, carbon dioxide and hydrogen are salts of the alkali, alkaline earth and transition metals. Some studies undertaken to elucidate the mechanisms of catalysis have utilised simpler and purer carbon structures than coal in addition to coal chars. Several mechanisms have been proposed for the behaviour of catalysts in gasification but detailed mechanisms are still the subject of much speculation. However, in oxidative gasification, it is likely that an oxygen transfer mechanism is operative and a scheme is proposed which accommodates most of the theories put forward. In hydrogasification a spill-over mechanism, whereby hydrogen is transferred to the carbon structure, is feasible. The effects of coal properties on cata-

lytic gasification and catalyst activity in terms of impregnation, dispersion and deactivation are discussed. 146 references, 23 figures, 4 tables.

49360 **(ORNL/TM—8946) Evaluation of two conceptual wastewater treatment schemes for a Lurgi-based indirect coal liquefaction plant.** Villiers-Fisher, J.F.; Singh, S.P.N. (Oak Ridge National Lab., TN (USA)). Sep 1984. Contract AC05-84OR21400. 89p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85001731.

The objective of this study was to evaluate two conceptual treatment schemes for decontaminating the wastewaters likely to be generated in a conceptual dry-ash Lurgi-based indirect coal liquefaction plant. The conceptual indirect coal liquefaction plant is an integrated (i.e., all utilities generated onsite) facility designed to convert 15,000 tons of moisture- and ash-free coal per stream day to motor gasoline using dry-ash Lurgi coal gasification, Imperial Chemical Industries' methanol synthesis, and Mobil's methanol-to-gasoline processes. The conceptual plant is premised to be located at a generic site in the eastern United States and processes a generic Interior Basin high-sulfur bituminous coal. The following conclusions can be drawn from this assessment: (1) On paper, wastewater treatment facilities can be designed that are projected to treat the indirect coal liquefaction plant wastewaters to a level where the effluent will likely meet the current regulations for aqueous effluents for allied industries such as coke ovens and petroleum refineries. (2) The estimated capital investments, in 1983 US dollars, for the Case I (surface-discharge) and Case II (zero-aqueous-discharge) schemes are approximately $440 million and $550 million, respectively. These costs represent about 15 and 20% of the estimated capital investment for the integrated indirect coal liquefaction plant. (3) Case II (zero-aqueous-discharge) wastewater treatment is likely to result in the accumulation of approximately 1 million tons of toxic solid wastes during the 30 years of plant operation.

49361 **(PB—84-202480) Organic and inorganic mercury species in the Ft. Lewis solvent refined coal pilot plant water treatment process. Technical report.** Filby, R.H.; Blomquist, B.W. (Washington State Univ., Pullman (USA). Nuclear Radiation Center). Dec 1983. 55p. NTIS, PC A04/MF A01.

Prepared in cooperation with Washington State Water Research Center, Pullman.

The distribution of Hg in the water treatment process of the Ft. Lewis Solvent Refined Coal (SRC II) pilot plant was measured when the plant was operating in a production mode (50 tons coal per day). Mercury was found to concentrate in sulfide-rich process waters as the HgS2(2-) ion. In the treatment of organic-rich wastewaters, Hg precipitates on dilution as HgS and is also concentrated in the biosludge and clarifier sludge (Al(OH)3) of the process. A concentration of 2610 micrograms Hg/g (dry weight basis) was observed in the biosludge. Effluent waters from the treatment process contained 0.2 micrograms Hg/mL, compared to previously determined values of 2 to 5 micrograms Hg/mL.

49362 **(UCID—20173) Centralia double module in situ coal gasification test conceptual design.** Hill, R.W. (Lawrence Livermore National Lab., CA (USA)). 14 Sep 1984. Contract W-7405-ENG-48. 23p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000977.

The encouraging results of the Centralia Partial Seam CRIP Test have led to this proposal for a second test to further develop a method for the economic recovery of unminable coal reserves by in-situ gasification. This test will build on the results of the previous experiment and will have several important features of its own. This test was designed to meet the requirements set forth by the technical steering committee convened by WIDCO in January 1984. The test will be operated for 100 days to allow for repetitive testing of the CRIP method and to provide good resource recovery data. The surface facilities will have sufficient redundancy and be of sufficient quality to insure reliable operation, and be a prototype for commercial surface plant design. Two modules will be gasified and allowed to interact part way through the test to observe the effect of burn cavity interaction on product gas heating value. Vertical production wells will be used on one module and a slant production well on the other module to test the effectiveness of these two production methods on the performance of a long duration burn. The basic design for the test is illustrated by a drawing. Directional drilling was chosen as the linking technique since it gives the greatest control of the test geometry. This test is designed to provide both technical and economic evaluation of the CRIP method for controlling average gas quality, of the performance comparison of vertical and slant production well systems, and of interacting versus non-interacting burn cavities. The redundancy provided by the backup production wells and the long injection channels is in accord with the overall goal of reliable, long-term operation. This design is considered to be conceptual and some modifications may be required for the final test design. 3 figures.

49363 **Recovery of alkali metal constituents from catalytic coal conversion residues.** Soung, W.Y. (to Dept. of Energy). US Patent 4,459,138. 10 Jul 1984. Filed date 6 Dec 1982. vp.

PAT-APPL-447350.

In a coal gasification operation (32) or similar conversion process carried out in the presence of an alkali metal-containing catalyst wherein particles containing alkali metal residues are produced, alkali metal constituents are recovered from the particles by contacting them (46, 53, 61, 69) with water or an aqueous solution to remove water-soluble alkali metal constituents and produce an aqueous solution enriched in said constituents. The aqueous solution thus produced is then contacted with carbon dioxide (63) to precipitate silicon constituents, the pH of the resultant solution is increased (81), preferably to a value in the range between about 12.5 and about 15.0, and the solution of increased pH is evaporated (84) to increase the alkali metal concentration. The concentrated aqueous solution is then recycled to the conversion process (86, 18, 17) where the alkali metal constituents serve as at least a portion of the alkali metal constituents which comprise the alkali metal-containing catalyst.

49364 **Heat exchanger for coal gasification process.** Blasiole, G.A. (to Dept. of Energy). US Patent 4,455,154. 19 Jun 1984. Filed date 16 Apr 1982. vp.

PAT-APPL-369720.

This invention provides a heat exchanger, particularly useful for systems requiring cooling of hot particulate solids, such as the separated fines from the product gas of a carbonaceous material gasification system. The invention allows effective cooling of a hot particulate in a stream (made up of hot particulate and a gas), using gravity as the motive source of the hot particulate. In a preferred form, the invention substitutes a tube structure for the single wall tube of a heat exchanger. The tube structure comprises a tube with a core disposed within, forming a cavity between the tube and the core, and vanes in the cavity which form a flow path through which the hot particulate falls. The outside of the tube is in contact with the cooling fluid of the heat exchanger.

49365 **Air-flow regulation system for a coal gasifier.** Fasching, G.E. (to Dept. of Energy). US Patent 4,453,948. 12 Jun 1984. Filed date 30 Nov 1982. vp.

PAT-APPL-445641.

An improved air-flow regulator for a fixed-bed coal gasifier is provided which allows close air-flow regulation from a compressor source even though the pressure variations are too rapid for a single primary control loop to respond. The improved system includes a primary controller to control a valve in the main (large) air supply line to regulate large slow changes in flow. A secondary controller is used to control a smaller, faster acting valve in a secondary (small) air supply line parallel to the main line valve to regulate rapid cyclic deviations in air flow. A low-pass filter with a time constant of from 20 to 50 seconds couples the output of the secondary controller to the input of the primary controller so that the primary controller only esponds to slow changes in the air-flow rate, the faster, cyclic deviations in flow rate sensed and corrected by the secondary controller loop do not reach the primary controller due to the high frequency rejection provided by the filter. This control arrangement provides at least a factor of 5 improvement in air-flow regulation for a coal gasifier in which air is supplied by a reciprocating compressor through a surge tank.

49366 **Purged window apparatus utilizing heated purge gas.** Ballard, E.O. (to Dept. of Energy). US Patent 4,443,072. 17 Apr 1984. Filed date 5 Apr 1982. vp.

PAT-APPL-365133.

A purged window apparatus utilizing tangentially injected heated purge gases in the vicinity of electromagnetic radiation transmitting windows, and a tapered external mounting tube to accelerate these gases to provide a vortex flow on the window surface and a turbulent flow throughout the mounting tube. Use of this apparatus prevents backstreaming of gases under investigation which are flowing past the mouth of the mounting tube which would otherwise deposit on the windows. Lengthy spectroscopic investigations and analyses can thereby be performed without the necessity of interrupting the procedures in order to clean or replace contaminated windows.

49367 **(DOE-tr—5002149) Alternating-pressure underground gasification.** Breidung, P.; Guntermann, K.; Kurth, M.; Ropertz, G. (EG and G/Washington Analytical Services Center, Inc., Morgantown, WV (USA); Technische Hochschule Aachen (Germany, F.R.). Inst. for Metallurgical Science). 1984. Contract AC07-76ID01570. Translated from NP—4770030, pp 691-708. 21p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002149.

The goal of the research program is the production of artificial natural gas, reduction gas or other fuel gases through coal gasification, using hydrogen, air or oxygen/steam mixtures in the coal seam itself, particularly in deep coal beds. Emphasis is on the pressure-change (pressure-swing) technique for accomplishing gasification. A simulation study of underground operation and a feasibility study are under way. The objective necessitates some experimental work in various test facilities and also modelling of the underground gasification process. Materials data and kinetic data were obtained with a small autoclave, using coal and coke lumps 170 mm diameter and 200 mm long. The following series of tests were conducted: (1) pyrolysis tests; (2) hydrogenation-gasification tests; (3) gasification tests with air; and (4) gasification tests with air-steam mixtures and oxygen-enriched air-steam mixtures. Using coal samples 1,000 mm long and 170 mm diameter two series of tests were initiated: (1) gasification tests in connection with filtration processes, in which permeability to gas was measured during gasification and (2) channel combustion tests. The large autoclave facility was used with coal samples 4 m long and 32 cm diameter to investigate: (1) channel gasification processes; (2) reverse combustion; and (3) processes which promote flow around the block, with steady pressure and pressure-change conditions. Results are discussed. 10 references, 5 figures, 1 table.

49368 **Equilibrium measurements for the absorption of H_2S, COS and HCl by alkali metal carbonates.** Lyke, S.E.; Sealock, Z.J. (Battelle Pacific Northwest Laboratories, Richland, WA). *Proceedings - Electrochemical Society;* **84-2**: 639-648(May 1983). (CONF-8305100—).

From 4. Electrochemical Society international symposium on molten salts; San Francisco, CA, USA (8 May 1983).

Battelle Pacific Northwest Laboratories (PNL) has developed through the bench scale a process to remove H_2S and COS from hot fuel gas with a solution of Li, K, Na and Ca carbonates supported on a solid substrate. In order to extend this process to operate in integrated coal gasification/molten carbonate fuel cell power plants, equilibrium data are needed for various cation compositions in the presence of high CO_2 and H_2O back pressures. A pressure-capable laboratory system has been recently constructed and is being used to study the carbonate/sulfide, carbonate/sulfate and carbonate/chloride equilibria.

49369 **(BG-Trans—5898) Method for the preparation of a gaseous fuel.** (British Gas Corp., London; Shell Internationale Research Maatschappij N.V., The Hague (Netherlands)). 1982. Translation of Dutch Patent No. 7 812 292, December 19, 1978. 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84901725.

A method is disclosed for the preparation of a gaseous fuel with a calorific value of at least $^{30}MJ/m^3$, from carboniferous materials using a catalyst mixture. This catalyst comprises zinc and/or copper, and a crystalline silicate. (DLC)

49370 **Properties and performance of materials in the coal gasification environment.** Hill, V.L.; Black, H.L. Metals Park, OH, USA; American Society for Metals (1981). 828p. (CONF-800997—). American Society for Metals, Metals Park, OH 44073.

From Conference on the properties and performance of materials in the coal gasification environment; Pittsburgh, PA, USA (8 Sep 1980).

This book contains the proceedings cosponsored by the Gas Research Institute, Metal Properties Council, Inc., American Society for Metals, and US Department of Energy. A large part of the conference covered materials testing conducted in simulated and actual coal-gasification conditions under the auspices of Subcommittee 9 of the MPC. Many of the investigators who have been active in evaluating materials for coal-conversion service during the past few years also contributed to the proceedings. Accordingly, this book is a valuable reference work on materials behavior in the chemically aggressive, high-temperature, high-pressure environments of coal-gasification plants.

49371 **Comments on coal conversion program.** Huntington, S. pp 70-76 of Research report to American Electric Power Service Corporation on position statements by other concerned organizations. Appendix A. Columbus, OH; Battelle Columbus Laboratories (1980).

Reasons for opposition to the proposed Clean Air Act modifications are given relative to acid rain.

49372 **Alternative modes of processing SRC in an expanded-bed LC-finer to produce low-nitrogen distillates.** Chillingworth, R.S. (Cities Service Co.); Unger, H.; Hastings, K.E.; Potts, J.D. *AIChE National Meeting;* No. 34D, 1-27(1979). (CONF-790405—).

From AIChE meeting; Houston, TX, USA (1 Apr 1979).

In a continuing program to upgrade solvent refined coal (SRC-1) supported by the U.S. Department of Energy, runs made in LC-Fining laboratory process development units of the C-E Lummus Co. with commercially available catalysts demonstrated that the proportion of solvent can be reduced from 50 to 30%; processing with a higher boiling range solvent increases conversion and denitrogenation; a Wyoming coal from the Amax Belle Ayr mine can be processed; and operations with cool noncatalytic zones yield a lower over-all conversion but identical denitrogenation. A distillate product (390°-850°F) contained 0.3% nitrogen. The conversion of 850°F+ is essentially thermal whereas denitrogenation and desulfurization are catalytic.

49373 **Process design and economic evaluation of a conceptual 100,000 bbl/day synthoil plant.** Salmon, R.; Edwards, M.S.; Ulrich, W.C.• (Oak Ridge Natl. Lab.). *AIChE National Meeting;* No. 55a, 1-27(1978). (CONF-780611—).

From AIChE symposium; Philadelphia, PA, USA (4 Jun 1978).

The process design and economic evaluation of a conceptual 100,000 bbl/day synthoil plant charging 50,000 tons/day of western Kentucky coal and also producing 2130 tons/day of sulfur and 180 tons/day of ammonia was prepared, based on experimental data obtained on a 0.5 ton/day unit at the Pittsburgh Energy Research Center. The planned facility consisted of about 15 process units, including a 12,000 ton/day oxygen plant and an entrained-bed gasification plant. The reactor was designed to operate at an 810°F inlet temperature, an 860°F outlet temperature, at 4000 psig, and with a total hydrogen consumption of 556 million cu ft/day. Over-all plant thermal efficiency was estimated at 59.6%. The estimated over-all capital investment for the facility was, on a 1976 basis, $1900 million, of which $1670 million was depreciable; the cost of the coal mine was excluded. When the product oil cost was calculated and plotted as a function of the coal cost and the annual after-tax rate of return on equity for capital structures from 100% equity to 95% debt, with the assumptions of a 9% annual interest rate on debt and 5 yr of construction followed by 20 yr of operation. As an example, the product oil cost $22.60/bbl based on a debt-equity ratio of 70:30, a 12%/y after-tax rate of return on equity, and a $20/ton coal cost. Diagram, flowcharts, graphs and tables.

49374 **Coal liquefaction in a syntholl reactor without added catalyst.** Rogers, S.E.; Mazzocco, N.J.; Akhtar, S.; Yavorsky, P.M. (Dept. of Energy, Pittsburgh Energy Res. Cent.). *AIChE National Meeting;* No. 55c, 1-25(1978). (CONF-780611—).

From AIChE symposium; Philadelphia, PA, USA (4 Jun 1978).

In studies at the U.S. Department of Energy, Pittsburgh Energy Research Center, parallel packed-bed runs of the liquefaction of Kentucky coal over silica/alumina-supported cobalt/molybdenum catalyst and over inert glass beads, designed to determine the catalyst activity, revealed that an acceptable fuel oil of low sulfur content was produced in high yields without the catalyst. The runs were carried out at 450°C preheater and reactor temperature, 400 psig, a 25 lb/hr coal/oil slurry feed rate, 1000 cu ft/hr recycle gas rate, and 350 cu ft/hr makeup gas rate for up to 1068 hr to give a stable conversion of 95-98%, measured as benzene-soluble oil. Presumably, a combination of high-velocity contacting plus indigenous catalysis by the minerals in the coal, especially iron sulfide, achieved the hydroliquefaction. The catalyst decayed completely in 300 hr. The product oils, after the first centrifugation, had viscosities of 30-130 SSF from the inert and 32-220 SSF from the catalytic packing, and heating values of 16,600 Btu/lb from inert and 17,200 Btu/lb from the catalytic packing.

49375 **Coal liquefaction and deashing studies--2. Solvent refined coal process.** Kleinpeter, J.A.; Jones, D.C.; Dudt, P.J.; Burke, F.P. (Conoco Coal Dev. Co.). *AIChE National Meeting;* No. 55E, 1-36(1978). (CONF-780611—).

From AIChE symposium; Philadelphia, PA, USA (4 Jun 1978).

In a laboratory-scale study performed under Fort Lewis Solvent Refined Coal (SRC) Pilot-Plant conditions with Kentucky coal, integrated gravity settling produced an SRC with 0.1% ash content if Soltrol 130 paraffinic naphtha was added as antisolvent in 0.3:1 to 0.5:1 antisolvent/liquefaction solvent ratio. Higher ratios produced clogging deposits. SRC pilot-plant filter feed containing 10% solids was used in the tests, and 86% was recovered as deashed product. The separation was sensitive to upflow velocity, and a low velocity of 0.4 in./min was required in an 8 in. settler. A commercial plant processing 25,000 tons/day of coal would require thirty-two 40 ft dia settlers. Recycled Soltrol 130, contaminated with 6% tar acids and ~ 12% nonparaffinic materials, had a much lower efficiency than fresh solvent; the Kauri-Butanol value correlated linearly with the efficiency. Various other aspects of the process are also discussed.

0105 By-products

REFER ALSO TO CITATION(S) 01050050088

0106 Properties

REFER ALSO TO CITATION(S) 01060049353, 49396, 49397, 49422, 49431, 49753, 50326, 50530

49376 **(CONF-8408106—1) Premium Coal Sample Program: a model.** Vorres, K.S. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84015830.

From Standards in biomass for energy and chemicals workshop; Gaithersburg, MD, USA (1 Aug 1984).

The Premium Coal Sample Program at the Argonne National Laboratory is intended to provide high quality, well characterized coal samples to the basic research community involved in coal studies. The overall goals will be described, as well as the collection, transport, processing, analysis and distribution of the samples. Similarities and differences between coal and biomass samples will be discussed. A number of questions for processing, which need to be considered, are addressed. 1 reference.

49377 **(DOE/FE/60181—64) Comparison of low-rank coal ash sintering characteristics with pilot plant ash fouling tendencies.** Conn, R.E.; Jones, M.L. (North Dakota Univ., Grand Forks (USA). Energy Research Center). 1984. Contract FC21-83FE60181. 24p. (CONF-840729—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85000916.

From 3. conference on slagging and fouling due to impurities in combustion gases; Copper Mountain, CO, USA (29 Jul 1984).

The objective of this work was to develop a simple laboratory test for evaluating the fouling tendencies of low-rank coal ashes. Simultaneous ash shrinkage-electrical resistance measurements were performed to determine the sinter points of various coal ashes. In addition, the compressive strength of sintered ash pellets was determined to give an indication of the apparent bonding strength. The factors studied include ash composition, ash time-temperature history and particle size. Sintering tests appeared, from this preliminary evaluation, to be a satisfactory bench-scale method for evaluating the fouling behavior of low-rank coals. These tests correlated well with the observed fouling behavior of coals in the UNDERC test furnace. There was a strong correlation between pilot plant ash fouling tendency and the amount of shrinkage observed and the compressive strength of ASTM and fly ash samples heated above their sinter points. In summary, the small amount of material required, the ability to use laboratory-produced ash rather than fly ash, and the low cost of the techniques are desirable characteristics for a test of fouling propensity. In addition, these techniques should prove useful in studies to clarify the mechanisms of particle-to-particle bonding involved in deposit formation. This together with information of the metal-ash bonding should help to both explain and predict fouling behavior of low-rank coal in combustion systems. 10 references, 9 figures, 5 tables.

49378 **(DOE/FE/60181—1642) Low-rank coal research. Quarterly technical progress report, April-June 1984.** (North Dakota Univ., Grand Forks (USA). Energy Research Center). Aug 1984. Contract FC21-83FE60181. 268p. NTIS, PC A12/MF A01; 1; GPO Dep. File Number DE84017327.

Papers in the quarterly technical progress report for the period April-June, 1984, of the Low-Rank Coal Research project have been entered individually into EDB and ERA (17 items). (LTN)

49379 (DOE/FE/60181—1642, pp 14.1-14.6) **Organic structure.** Olson, E.S.; Diehl, J.W. Aug 1984. NTIS, PC A12/MF A01. File Number TI84017327.

In Low-rank coal research. Quarterly technical progress report, April-June 1984.

One of the important parameters in the characterization of macromolecules derived from coal is the average molecular weight of the material. Information on the molecular weight distribution of a sample can aid in understanding the behavior of the macromolecule in various chemical and physical processes. The goal of this research in lignite macromolecules is to find a way to apply polymer characterization methods such as low-angle laser light scattering (LALLS) photometry in a static mode and also in a coupled mode with size exclusion chromatography (SEC) or gel permeation chromatography to the analysis of macromolecules derived from coal by oxidation, pyrolysis, supercritical extraction, and chemical extraction. Although size exclusion chromatography is an excellent technique for separating polymers on the basis of size, it does not directly provide molecular weight data. The calibrations necessary to determine the molecular weights of eluted molecules and consequently obtain molecular weight distributions from the retention times are subject to large errors. Since the low-angle laser light scattering photometer gives absolute molecular weight data, no calibration of the size exclusion chromatography column is necessary. Previous investigations with coal-derived macromolecules have been hindered by the intense absorptions of the light, making scattering difficult to observe. The high molar absorptivity is believed to result from extensive conjugation of arene systems, nitrogen heterocyclics, and semiquinone structures. Our objectives are to carry out mild hydrogenation and reduction reactions which would hydrogenerate the arene systems and reduce the semiquinones without changing the size of the macromolecule. 4 figures.

49380 (DOE/FE/60181—1642, pp 15.1-15.15) **Distribution of inorganics.** Benson, S.A.; Hurley, J.P.; Steadman, E.N. Aug 1984. NTIS, PC A12/MF A01. File Number TI84017327.

In Low-rank coal research. Quarterly technical progress report, April-June 1984.

Chemical fractionation was performed on the coals and lithotypes to determine the percent of elements associated as soluble salts or cations extractable with 1M ammonium acetate, the carbonates/oxides/coordinated species extractable with 1M hydrochloric acid, and the insoluble inorganic phases such as quartz, clay minerals, and pyrite. The extracts and residues were analyzed by a combination of x-ray fluorescence (XRF), neutron activation (NAA), and inductively coupled argon plasma spectroscopy (ICAP). The data presented are not complete and are subject to change because not all of the XRF and NAA analyses have been completed. 7 references, 1 table.

49381 (DOE/FE/60181—1642, pp 16.1-16.19) **Physical properties and moisture.** Hauserman, W.B.; Tye, C. Aug 1984. NTIS, PC A12/MF A01. File Number TI84017327.

In Low-rank coal research. Quarterly technical progress report, April-June 1984.

The objective of this study is to characterize coals by their fracture characteristics, expressed in terms of shifts in particle size distribution functions during standardized tumbling and heating procedures. The scope has been limited to establishing a methodology by which to provide fundamental data on the structure of coals and their individual lithotypes. Qualitatively, there are three mechanisms of ideal, brittle fracture behavior: crushing, impact and attrition. An ideal brittle solid is one such that all particles of it, when subjected to an equal probability or severity of mechanical or thermal abuse, will have an equal probability of breaking into the same proportional size and number of smaller particles. In spite of their heterogeneous, non-isotropic structure, most coals come surprisingly close to ideal brittle solid behavior. The methods developed in this study express coals' fracture behavior numerically, as ideal brittle solids and indicate graphically where they depart from ideal behavior. Crushing and impact severe enough to transmit destructive forces throughout a particle result in such approaches to ideal behavior. During heating, differential thermal expansion and structural weakening due to moisture removal have a similarly uniform effect on the breakage patterns of non-caking coals. Abrasion is the result of mild mechanical damage, in which destructive forces do not penetrate initial particles deeply enough to cause massive fracturing. Mechanical deviation from ideal fracture behavior results from variation in fragility of a coal's different lithotypes or concentrations of mineral components. Thermal deviation from ideal behavior occurs in caking coals, which display a reverse thermal friability. 13 references, 14 figures, 3 tables.

49382 (DOE/PC/50797—T7) **Novel analytical approaches to the study of coal beneficiation. Quarterly report.** Griffiths, P.R. (California Univ., Riverside (USA). Dept. of Chemistry). 1984. Contract FG22-82PC50797. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017396.

Work during this period was designed to investigate the effect of minerals as potential catalysts for oxidation reactions. Coals of four different ranks were studied, namely medium volatile bituminous, high volatile B bituminous, subbituminous B, and lignite. Three coals of each rank were selected with a high, intermediate and low mineral content, and from geographically diverse areas. Samples were ground in a ball mill for two minutes each to reduce the average particle size to about 10 μm. They were held in a 150°C oven for eight days and aliquots were removed each day. The diffuse reflectance spectra of these samples were measured. The intensity of the carbonyl peak at 1725 cm^{-1} was used as a measure of the extent of oxidation. The rate of oxidation was greatest for coals of the higher rank. For coals of a given rank, however, the rate of oxidation did not appear to correlate with the percent mineral matter in the coal. This result was quite surprising, since 150°C is a rather low temperature for the air oxidation of most organic functional groups, and we originally expected to observe some indication that catalysis, probably by trace transition metals present in minerals was a significant factor in the oxidation rate. 6 figures.

49383 (DOE/PC/72007—2) **Ultra-fine coal characterization. 2nd quarterly report, June 1, 1984-August 31, 1984.** Smit, F.J.; Odekirk, J.R. (Amax Extractive R and D, Inc., Golden, CO (USA)). 19 Sep 1984. Contract AC22-84PC72007. 39p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85000570.

This report covers the second quarter of activity on the project to characterize the mineral-matter liberation and the beneficiation of ultra-fine coal. So far the work has been confined to the base-case coal from the Illinois No. 6 seam. Eight other coals will be examined later in the program. The work accomplished this quarter, and described in this report, included determination of additional bulk properties of the coal, an examination of the mineral-matter and mineral associations in the coal, and the preparation and washability testing of ultra-fine, minus 44-micrometer (325-mesh) coal for liberation studies. 8 references, 8 figures, 13 tables.

0108 Waste Management

REFER ALSO TO CITATION(S) 01080049331, 49361, 49432, 49434, 49754, 49755, 49756, 50437, 50438

49384 (CONF-831244—3) **Solid wastes from coal and shale: projections of waste forms and utilization potential.** Watson, J.S.; Boegly, W.J. Jr.; Francis, C.W.; Canon, R.M. (Oak Ridge National Lab., TN (USA)). 1983. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000945.

From 2. conference on municipal, hazardous and coal wastes management; Miami Beach, FL, USA (5 Dec 1983).

Coal mining wastes are suitable for reclamation purposes and could be used for landfill except that transport costs make that application prohibitive. Coal cleaning wastes contain significant quantities of carbon, thus have considerable energy content. Unfortunately, high amounts of sulfur are also contained in the tailings so that if combustion is an option the combustion method will require effective pollution control measures. One possibility is fluidized-bed combustion. Ashes and chars are produced by electric power plants and coal conversion plants. Considerable R and D is being devoted to the utilization of these wastes in the building industry and as sources of alumina and other minerals. Slags from flue gas desulfurization are used as sources of elemental sulfur and natural gypsum. Fluidized-bed combustion wastes are being considered for agricultural applications or for use as road bases. Large volumes of wastes from shale processing present utilization potential as well. Spent western shale is being considered as a source for alumina. The wastes from Chattanooga shales are being considered as a source for uranium. More R and D needs to be focused on the utilization of shale wastes. (DMC)

49385 (DOE/ET/15492—T58) **Laboratory/bench scale testing and evaluation of A.P.T. dry plate scrubber. Fifty third monthly report, July 1-31, 1984.** (Air Pollution Technology, Inc., San Diego, CA (USA)). 28 Aug 1984. Contract AC21-80ET15492. 16p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016291.

The objective of this project is to conduct a bench scale experimental evaluation of the dry plate scrubber (DPS) at high temperature and pressure to determine its potential for controlling particulate and alkali vapor emissions from PFBC processes. The technical objective for July was to: continue DPS experiments to study ash cake accumulation phenomenon. The remaining test program on the HTP-DPS experiments will start after completing the ash cake accumulation experiments. The test plan for the remaining experiments was outlined and presented in the last monthly technical report. The HTP-DPS experiments will be performed with either alumina collectors or zirconia collectors. We have recommended zirconia collectors. This involves an increase in cost and this cost was submitted during the month. The work on the process design will be continued after completing the HTP-DPS experiments described above. It is anticipated that the above test plan will provide information on collector feed rates and collector to stone ratio for optimum system design. During this reporting period, two tests (Run No. 52/03 and 53/01) were completed to establish baseline ash accumulation characteristics. One test (Run No. 52/02) was

performed to obtain the temperature profile of gas stream after replacing the heaters. The test conditions and data analysis for these three runs are presented and the test procedure is briefly described.

49386 **(DOE/MC/08707—T1) Sour water stripping of coal gasification waste water. Final report.** Verhoff, F.H.; Choi, M.K. (West Virginia Univ., Morgantown (USA). Dept. of Chemical Engineering). 1979. Contract AT21-77MC08707. 108p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE84017558.

Coal gasification at the METC gasifier produces an aqueous decanter waste which must be treated before it can be disposed. The initial attempts for treating the waste was biological decomposition; this work had already been started in 1976. In the summer of 1977, it was realized that the biological treatment would not be successful unless the ammonia and hydrogen sulfide were removed from the waste since these materials were interfering with the biological activity. It was then suggested that the present project be initiated to study the stripping of ammonia and hydrogen sulfide from the water. A computer model which would predict the vapor-liquid equilibrium for carbon dioxide-ammonia-water-hydrogen sulfide-organics was developed. This model was then used for the preliminary design of the stripping column. There are two basic conclusions to the study. First, a significant fraction of the organics (in the range of 50%) will be removed in the steam. This organic loss in the steam severely limits the utility of the stripping column. There are two possible means of overcoming this difficulty; a distillation column could be installed instead of the stripping column or valuable compounds could be recovered from the steam. Only the latter alternative has any chance for economic viability. The second important conclusion obtained from the study is that in any process for the removal of ammonia and hydrogen sulfide, the sour water should first be passed through a flash drum to remove the majority of the carbon dioxide before entering the stripping column. 42 references.

49387 **(DOE/METC—84-5) Proceedings of the third biennial synfuels wastewater workshop.** King, C.J. (comp.). (California Univ., Berkeley (USA)). Mar 1984. Contract AC03-76SF00098. 229p. (CONF-830643—). NTIS, PC A11/MF A01; 1; GPO Dep. File Number DE84009294.

From 3. biennial synfuels wastewater workshop; Morgantown, WV, USA (15 Jun 1983).

The Third Biennial Synfuels Wastewater Workshop, sponsored by the US Department of Energy, Morgantown Energy Technology Center, has contributed valuable information to the technical data base on pollution control options for the treatment of wastewaters from synfuel facilities. The results of the research presented at this third biennial workshop have added significantly to the data base previously established from the prior workshops under the sponsorship of the Office of Environmental Control Technology, US Department of Energy. The significant finding of this recent workshop is encouraging in that the consensus of opinion was that sufficient information is now available to design and construct a commercial-scale facility, albeit conservatively, which can adequately treat synfuel wastewaters. It was agreed however that some uncertainties still exist with respect to wastewater characterization and the performance of various wastewater treatment processes which could be resolved by further tests at the pilot-scale level. It is hoped that the findings of this workshop will provide guidance for future synfuels wastewater research activities. Areas which were highlighted for continued research include the investigation of innovative wastewater treatment methods (both physicochemical and biological) which can significantly reduce processing costs over conventional treatment schemes; investigation of the effects of stream and sample reliability and representativeness on conceptual design studies and pilot plant operations; more detailed characterization of organic compounds in synfuel condensates; and the determination of potential health and ecological effects of refractory constituents in synfuel wastewaters. Abstracts were prepared for 19 status reports for inclusion in the Energy Data Base.

49388 **(DOE/METC—84-6) Contaminant control in hot coal derived gas streams: proceedings.** Markel, K.E. (ed.). (USDOE Morgantown Energy Technology Center, WV). Dec 1983. 481p. (CONF-8305112—). NTIS, PC A21/MF A01; 1; GPO Dep. File Number DE84000216.

From 3. annual contractors' meeting on contaminant control in hot coal derived gas streams; Washington, PA, USA (24 May 1983).

The purpose of this meeting was to provide a forum for the exchange of information based on presentations reflecting recent progress in the technology development, device and instrumentation testing. The sessions focused on where Pressurized Fluidized Bed Combustion and Coal Gasification Systems are, where they are going, and the role cleanup technology does and will play so as to place the work in perspective. A panel discussion and an open forum were held on Wednesday evening to explore formation and control of alkali compounds in pressurized fluidized bed combustion systems. All papers (24 total) have been processed for inclusion in the Energy Data Base.

49389 (DOE/METC—84-6, pp 219-243) **Testing and verification of granular bed filters for removal of particulates and alkalis.** Lippert, T.E.; Ciliberti, D.F.; O'Rourke, R.; Pirrmann, R.A.; Russell, R.A.; Zenz, F.A. (Westinghouse Electric Corp., Pittsburgh, PA; Ducon, Inc., Mineola, NY). Dec 1983. NTIS, PC A21/MF A01. File Number DE84000216. (CONF-8305112—).

From 3. annual contractors' meeting on contaminant control in hot coal derived gas streams; Washington, PA, USA (24 May 1983).

The Granular Shallow Bed Filter (GBF) is proposed as a device to clean particulates from Pressurized Fluidized Bed Combustion (PFBC) gas streams. The GBF is a device in which the dust-laden gas passes through a shallow granular bed, depositing the particulate matter on the surface of the granular media. The bed media is cleaned by a reverse flush that gently fluidizes the bed and elutriates the collected particulate matter from the system. Described herein are analyses and data that reflect on the GBF concept as it would apply to a PFBC and preliminary results of testing done on a six-element subpilot-scale GBF unit. A 500 acfm subpilot-scale GBF has been built and tested at both ambient and simulated PFBC conditions. Ambient flow tests were used as a basis to characterize the backflush system and evaluate candidate bed media. At simulated PFBC conditions, the test unit has been operated over 220 hours (cumulative), through 615 cleaning cycles in four test phases. Two different GBF test configurations have been utilized. Test variables have included bed media, filter flow face velocity, backflush conditions, and dust loading. Results of this test work show that the overall performance of the GBF can be improved by backflushing and cleaning utilizing a static bed system. Successful demonstration of this approach on an integrated basis remains to be shown. 7 references, 14 figures, 3 tables.

49390 (DOE/METC—84-6, pp 245-269) **High-temperature moving bed granular filter development at Combustion Power Company.** Guillory, J.L. (Combustion Power Co., Menlo Park, CA). Dec 1983. NTIS, PC A21/MF A01. File Number DE84000216. (CONF-8305112—). Contract AC21-77ET10373.

From 3. annual contractors' meeting on contaminant control in hot coal derived gas streams; Washington, PA, USA (24 May 1983).

A program sponsored by the US Department of Energy to develop a high-temperature moving bed granular filter (GBF) was conducted at Combustion Power Co., from 1978 to 1982. The objective was to investigate the performance of the GBF and develop hardware for application to direct coal-fired pressurized fluid bed turbine systems. Major accomplishments were: (1) successful operation of a 1600 acfm GBF on 1500 to 1600F gases from a coal-fired fluid bed combustor - overall collection efficiencies above 99% and submicron collection efficiencies in excess of 96% were demonstrated in over 1500 hours of high temperature testing. Operational and performance stability under severe upset conditions was demonstrated. No pluggage or other long-term performance degradation was observed. (2) Quantification of aluminosilicate-based alkali suppression - although limited to simple extractive measurement procedures, data was obtained that indicated there were sufficient aluminosilicates in the Illinois No. 6 coal ash to ensure above 99% conversion of inherent alkalis to solids for subsequent removal by cyclones and the GBF. (3) Development of a computer-based GBF performance model - a finite-difference model of GBF performance

was developed in which gas flow was based on fundamental principles and particulate capture was based on empirical models developed as a part of this program. It predicts overall capture within +- 0.2 percentage points and pressure drop within +- 5%. (4) Economic assessment of full-scale systems - a modular design was developed so that elements of the size tested in this program could be used in the full-size pressurized systems. Projected cost of a 30,000 acfm module for use in a 10 atm PFB power system is $27/acfm. 12 references, 14 figures, 2 tables.

49391 (DOE/METC—84-6, pp 271-280) **Electrostatic granular bed filter development program.** Christensen, D. (General Electric Co., Schenectady, NY). Dec 1983. NTIS, PC A21/MF A01. File Number DE84000216. (CONF-8305112—).

From 3. annual contractors' meeting on contaminant control in hot coal derived gas streams; Washington, PA, USA (24 May 1983).

A retest of the Electrostatic Granular Bed (EGB) filter was conducted at the DOE Morgantown atmospheric fluidized bed facility during August, 1982. The nominal test conditions were a flow rate of 270 acfm and a dust load of 2.1 gr/acf (15,000 ppM), and the filter inlet and outlet temperatures were 1400°F and 1200°F respectively. The general test objective of demonstrating equipment operability and media durability for 100 hours was demonstrated. The test was conducted without the pre-ionizer since the combination of low pressure and high temperature limits the ability to precharge the flyash. High filter efficiency was, therefore, not an objective, but a reasonable 92.5% total efficiency was measured. Post-test inspection of the filter revealed flyash deposits at the filter inlet face which may have eventually clogged the filter. These deposits are believed to be a consequence of abnormally high concentrations of large particles which were collected at the front face of the filter and which locally exceeded the self-cleaning capacity of the media. The test was run without a cyclone pre-cleaner, and Coulter Counter analysis of the flyash indicated that the average size entering the filter was 6 microns, which is twice that expected in the PFB application which utilizes two stages of cyclones upstream of the filter. A finer dust would have been collected deeper in the filter. The deposit problem may have been compounded by condensation of vapor phase alkali salts due to the temperature drop through the filter. 4 references, 14 figures.

49392 (DOE/METC—84-6, pp 281-297) **APT dry plate scrubber for particulate collection at high temperature and pressure.** Jain, R.; Yung, S.; Duncan, M.; Calvert, S.; Patterson, R. (Air Pollution Tech., Inc., San Diego, CA). Dec 1983. NTIS, PC A21/MF A01. File Number DE84000216. (CONF-8305112—).

From 3. annual contractors' meeting on contaminant control in hot coal derived gas streams; Washington, PA, USA (24 May 1983).

The APT Dry Plate Scrubber (DPS) uses one or more shallow, dense mobile beds of solid collector granules supported on perforated plates to remove impurities from a gas stream. Under the sponsorship of the US Department of Energy, APT evaluated the performance of a bench scale DPS under ambient conditions and on a slip stream of the flue gas from an atmospheric fluidized bed combustor and is currently determining the cleanup efficiency attainable at high temperature and high pressure (HTP) conditions. The DPS column is 20 cm diameter (8 in sch. 40) s.s 310 pipe. Overall height of the DPS is 152 cm (5 ft). The DPS column has space for up to 5 stages. The top stage is electrostatically augmented by applying an electric field to polarize the collectors. Particles can be charged in a wire and plate pre-charger. The DPS column, particle pre-charger, and collector hoppers are enclosed in a pressure vessel. Hot gas is produced by heating air with direct contact electric heater. Collector granules are 0.42 to 0.84 mm diameter alumina spheres. The collectors are stored in an overhead hopper and pre-heated to gas temperature before they are introduced to the DPS. The collector granules are recycled by pneumatic transport from the DPS bottom hopper to the DPS overhead hopper. Fly ash particles collected by the granules are shaken off the granules in the transport pipe and are carried away by the transport air. The operation of a multiple stage HTP-DPS showed that it is capable of operating at high temperature and high pressures. Plugging of the DPS plate is not a problem. A 5-stage electrostatically augmented DPS can clean the gas to meet the GE turbine requirements. Electrostatic augmentation at HTP improves the DPS efficiency. 7 references, 7 figures.

49393 (DOE/METC—84-6, pp 339-346) **Alkali removal from hot combustion gases by adsorption on submicron-size particles.** Christensen, D.K.; LeBlanc, O. (General Electric Co., Schenectady, NY). Dec 1983. NTIS, PC A21/MF A01. File Number DE84000216. (CONF-8305112—).

From 3. annual contractors' meeting on contaminant control in hot coal derived gas streams; Washington, PA, USA (24 May 1983).

A bench scale experiment has been formulated herein to demonstrate the feasibility of adsorbing alkali vapors on 100 Angstrom alumina spheres. A small burner rig would generate 35 lb/h of 1600°F combustion products containing 1 ppM of alkali vapor. An alumina smoke generator/burner would provide the required 27 ppM of particulates for adsorption. The degree of adsorption would be determined by measuring the alkali dew point. 3 references, 1 figure, 2 tables.

49394 (DOE/METC—84-6, pp 409-423) **Hot gas clean-up using porous ceramic cross flow filters.** Ciliberti, D.F.; Smeltzer, E.E.; Keairns, D.L. (Westinghouse Electric Corp., Pittsburgh, PA). Dec 1983. NTIS, PC A21/MF A01. File Number DE84000216. (CONF-8305112—).

From 3. annual contractors' meeting on contaminant control in hot coal derived gas streams; Washington, PA, USA (24 May 1983).

A program aimed at the development of a novel ceramic high temperature and pressure filter for Pressurized Fluid Bed Combustion, PFBC, is being carried out for the Department of Energy (DOE). In bench scale testing at 800°C and 11 atm these filters have demonstrated essentially 100% collection efficiencies at relatively high face velocities (3.35 m/min), with modest pressure drops and cycle times; (2 to 3 kPa) in 25 min. at a loading of 5000 ppM. Plans have recently solidified for testing the filter at an actual coal burning PFBC rig located at the Argonne National Laboratories. An economic evaluation of the cross flow filter has been carried out by Burns and Roe and Westinghouse. The results of this study indicate that implementation of the cross flow technology could reduce the specific hot gas cleaning capital cost from $125 $/kW for an all cyclone and conventional baghouse reference plant to 69 $/kW for one cyclone/cross flow filter plant. This is reflected in an overall reduction in the levelized busbar power cost of about 4%. An additional advantage is the compact nature of the cross flow plant as it requires 30% less site area. 2 references, 6 figures, 3 tables.

49395 (DOE/METC—84-6, pp 425-435) **Dust filtration using ceramic fiber filter media: a state-of-the-art summary.** Chang, R.; Sawyer, J.; Kuby, W.; Shackleton, M. (Acurex Corp., Mountain View, CA). Dec 1983. NTIS, PC A21/MF A01. File Number DE84000216. (CONF-8305112—).

From 3. annual contractors' meeting on contaminant control in hot coal derived gas streams; Washington, PA, USA (24 May 1983).

Filter media suitable for use at temperatures of >1000°F, employing ceramic fibers in their construction, have been under development for several years. These filter media are intended for application in the development of energy production processes such as pressurized fluidized bed combustion (PFBC), but will also be suitable for many diverse industrial processes. Ceramic media development work to date has shown significant progress toward achievement of a commercially viable high temperature filter. Tests have shown that at high temperature, fine particles can be collected efficiently and pressure drop can be controlled using pulse cleaning. Accelerated durability tests produce promise for long filter life. More work is needed in durability testing to detect application related problems and build the data base needed to move this important product development to commercialization. 5 figures, 6 tables.

49396 (KHM-TR—98) Use of basin ash as fill material on dry level. Soerensen, J.L.; Larsen, P. (Statens Vattenfallsverk, Vaellingby (Sweden). Projekt KOL-HAELSA-MILJOE). Jun 1983. 125p. (In Danish). NTIS (US Sales Only), PC A06/MF A01. File Number DE84751663.

In this report - which only deals with flyash as basin (- or lagoon) ash as fill material on dry level - the danish Amager power station flyash production and the experiments carried out to show its suitability as fill material in a 14-16 m high flyash embankment are being described. The first section of the report deals with the Amager power station flyash production and a description of how it is placed hydraulically in big basins for later excavation and dry storage for later use. The chemical as well as physical classification parameters of the flyash are mentioned and compared with experience collected from literature. Before making an embankment at the Kalvebodloeb (between Vestamager and Avedoere Holme) some experiments have been carried out on the Amager power station flyash. These consist of a little test area at the top of the Amager power station flyash stockpile and a replacement of uncontrolled partly organic fill material (ca. 25.000 m^3) with compacted flyash. It is described how to handle the flyash (from a contractors point of view) and the material properties (strength and deformation) are measured. Both laboratory tests (unconfined compression-, odeometer- and triaxial tests) and in situ tests (dry densities by the sand replacement method and plate loading tests) are mentioned. From the experience of the danish experiment and the literature the conclusion is thatdrained basin (lagoon) ash is a applicable fill material on dry level.

49397 (KHM-TR—99) Use of conditioned fly ash as fill material. Soerensen, J.L.; Larsen, D. (Statens Vattenfallsverk, Vaellingby (Sweden). Projekt KOL-HAELSA-MILJOE). 1983. 112p. (In Danish). NTIS (US Sales Only), PC A06/MF A01. File Number DE84751664.

In this report - which only deals with conditioned power station flyash as fill material on water-covered areas - the Stigsnaes, Denmark, power station flyash production and the experiments carried out to show its suitability as fill material are being described. The first main section of the report deals with the Stigsnaes power station flyash production (herein storage of the PFA). The physical and chemical classification parameters of the flyash and mentioned and compared with experience collected from literature. The second main section of the report deals with the Stigsnaes power station flyash as fill material. At the Stigsnaes power station flyash has been used as fill material on a water-covered area (up to 4 m water deapth) for an enlargement of the coal yard. It is discribed how to handle the flyash (from a contractors point of view), and the material properties (strength and deformation) are measured. The last mentioned is herein treated most thoroughly. Both laboratory tests (unconfined compression-, odeometer- and triaxial tests) and in situ tests (dry densities by the sand replacement method and plate loading tests) are mentioned. In the end of this section a few experiences from a harbour project in Aabenraa, Denmark, where conditioned flyash is used as fill material, are mentioned. The experience gained in Denmark and the literature show that conditioned fly ash is an applicable fill material both on dry level and on water-covered areas, but we have to carefully look on the chemical and physical conditions under which the flyash is used.

49398 (KHM-TR—105) Studies on the leaching and weathering processes of coal ashes. Liem, H.; Sandstroem, M.; Wallin, T.; Carne, A.; Blomqvist, L.; Thurenius, B.; Rydevik, U.; Moberg, P.O. (Statens Vattenfallsverk, Vaellingby (Sweden). Projekt KOL-HAELSA-MILJOE). May 1983. 401p. (In Swedish). NTIS (US Sales Only), PC A18/MF A01. File Number DE84751661.

The Swedish State Power Board has commissioned the Department of Inorganic Chemistry, the Department of Analytical Chemistry at The Royal Institute of Technology (KTH) and Scandiaconsult to make research studies within the project KHM 322 which is part of the Coal-Health-Environment project. Within the project KHM 322 we made leaching studies on the following types of coal combustion residues: fly ashes, bottom ashes, scrubber sludge, used bed material, other materials. Masspectrometric analysis show the ashes to contain about fifty elements. Coal ashes, scrubber sludge and used bed material contain considerable amounts of pH-buffering substances which will give the leachate a strong basic reaction (ph=9-13). Oil ashes give on the other hand an acid reaction (ph=2) when coming in contact with water. For a given type of coal the alcalinity of the fly ash is equal or greater than the corresponding bottom ash. The metal leaching from the different types of ashes has been compared for the metals, chromium, cobolt, nickel, copper, zinc, arsenic, selenium, molybdenum, cadmium and lead, under the same leaching conditions. The leaching of the metal was found to increase with pH for pH<=2 and ph>=9, to decrease with pH for 2 < pH < 6 and its minimum value at pH around 6 to 7. The effects for pH > 2 can be explained by solubility and complex formation equilibria. To study the effects ofleaching time on the metal leaching a set of long term experiments were carried out on some fly ashes and one bottom ash. For part of the ashes the leaching was carried out for up to 6 months with several changes of leachate and with leachate of different pH values. The pH of the leachate was found to reach quickly the equilibrium value and that the value then remained constant as long as there were pH buffering substances left in the ashes.

49399 (ORNL/TM—8835) Assessment of research and development for the management of fossil energy-related solid wastes. Boegly, W.J. Jr.; Watson, J.S.; Francis, C.W.; Canon, R.M. (Oak Ridge National Lab., TN (USA)). Oct 1984. Contract AC05-84OR21400. 50p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85001495.

Solid wastes are produced in all phases of the fossil energy fuel cycle, from extraction to energy production. Additional wastes are often generated as a result of the environmental controls required to ensure that effluents meet regulations. As in many other industries, process development in this area is more advanced than the environmental control technology. This assessment has been undertaken to evaluate currently used solid waste management methods as they relate to fossil energy technologies such as coal combustion and the processes for converting coal, oil shale, tar sands, and peat to gaseous or liquid fuels. Petroleum and biomass are not included in the assessment. Each of the solid-waste streams encountered in fossil energy production terminate with either disposal or utilization. Utilization is attractive, since it promises resource conservation and minimizes disposal. However, markets must be established for the recovered materials, and recovery methods must be developed that will make recycled waste products economically competitive with alternative raw material sources. Disposal may be a more costly method of waste management over the long term, since it implies the removal of any recoverable materials from the marketplace and, for the present land disposal operations, requires the commitment of large land areas. For the large waste volumes resulting from coal, oil shale, tar sand, or peat processing, the disposal options other than land burial are limited. Thus, there are strong incentives for the utilization of fossil fuel solid wastes. This assessment includes (1) a discussion of the current and future options for both disposal and utilization of fossil energy wastes, (2) an analysis of the problems imposed by regulatory and economic constraints on both disposal and utilization, and (3) a review of current research and development activities in these areas. 106 references, 2 figures, 8 tables.

49400 (SAIC—84/1782) Development of process for combined NO/sub x//SO/sub x/ control. Technical progress report, September 1984. (Science Applications, Inc., San Diego, CA (USA)). 15 Oct 1984. Contract AC22-83PC60265. 4p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000754.

Testing of copper-exchanged synthetic mordenite for combined SO_3 adsorption and NO/sub x/ reduction using ammonia as the reducing gas was begun. Column trading times varied from 109 to 163 minutes for greater than 99% SO_3 removal. The NO/sub x/ reduction efficiencies were greater than 70%, except for one run that was inexplicably low. Regeneration times and efficiencies were quite dependent on the regeneration gas. Hydrogen was better than CO or CH_4, which were about the same. Utilization efficiencies of the copper were high, which reduces the size of the adsorbent beds required.

49401 **(DOE/METC—84-26-Vol.3-Pt.1) Failure mode analysis for lime/limestone FGD system. Volume III. Plant profiles. Part 1 of 3.** Kenney, S.M.; Rosenberg, H.S.; Nilsson, L.I.O.; Oxley, J.H. (Battelle Columbus Labs., OH (USA)). Aug 1984. Contract AT02-80CH92122. 527p. NTIS, PC A23/MF A01; 1; GPO Dep. File Number DE84012008.

This volume contains plant profiles for: Petersburg 3; Hawthorn 3, 4; La Cygne 1; Jeffry 1, 2; Lawrence 4, 5; Green River 1-3; Cane Run 4, 5; Mill Creek 1, 3; Paddy's Run 6; Clay Boswell 4; Milton R. Young 2; Pleasants 1, 2; and Colstrip 1, 2. (DLC)

49402 **Performance of gas-atomized spray scrubbers at high pressure.** Yung, S.C.; Calvert, S.; Duncan, M. (Air Pollution Tech., Inc., San Diego, CA). *Journal of the Air Pollution Control Association;* **34**: No. 7, 736-742(Jul 1984). Contract AC21-79ET14812.

A large number of pressurized coal gasification processes being developed proposed to use venturi scrubbers for particulate removal at high pressures. Theoretical predictions based on venturi scrubber performance models indicate that particle collection efficiency will decrease severely in these high gas pressure applications. An exploratory theoretical and experimental program was performed to study the effect of gas pressure on venturi scrubber performance. Experiments were done on a 0.47 m^3/s (1000 acfm) pilot scale venturi scrubber. Particle collection performance was determined as a function of scrubber pressure drop for venturi scrubbers operating in the range of 1-10 atm total pressure. Experimental results confirmed that the particle collection efficiency of venturi scrubbers decreases for a given scrubber pressure drop as total gas pressure is increased. To achieve the same particle collection efficiency, the pressure drop across a venturi scrubber operated at 10 atm is about 10 times that of the same operated at 1 atm pressure.

49403 **Study of the reaction of SO_2 with $NaHCO_3$ and Na_2CO_3.** Keener, T.C.; Davis, W.T. (Univ. of Cincinnati, OH). *Journal of the Air Pollution Control Association;* **34**: No. 6, 651-654(Jun 1984). Contract AC18-80FC10184.

The results are presented of a study conducted to examine the reactivity of $NaHCO_3$ and its thermally decomposed product, Na_2CO_3, with SO_2 as a function of temperature and particle size in a simulated flue gas. The $NaHCO_3$ reaction was found to be significantly more efficient than the Na_2CO_3 reaction for temperatures less than 450°F (230°C) with a maximum efficiency of conversion occurring between 250 and 350°F. In the temperature range of 450-650°F, both compounds were observed to behave similarly. The Na_2CO_3 reaction with SO_2 was found to be dependent on particle size in the range of 20-200 μm for temperatures less than 450°F.

0109 Environmental Aspects

REFER ALSO TO CITATION(S) 01090049412, 49427, 50535, 50549

49404 **(CONF-801210—31-Draft) Health and environmental monitoring at the University of Minnesota-Duluth coal gasification facility. Draft.** Klein, J.A.; Clark, B.R.; Cowser, K.E.; Van Hoesen, S.D.; Wood, T.J.; Duhamel, A.P. (Oak Ridge National Lab., TN (USA); Minnesota Univ., Duluth (USA); USDOE, Washington, DC). 1980. Contract AC05-84OR21400. 29p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85001172.

From 3. Miami international conference on alternative energy sources; Miami Beach, FL, USA (15 Dec 1980).

The Life Sciences Synthetic Fuels Program at Oak Ridge National Laboratory was commissioned by the US Department of Energy (DOE) to implement an extensive environmental monitoring and sampling at the University of Minnesota-Duluth coal gasifier, part of the DOE Gasifiers in Industry Program. One aspect of the monitoring program has involved the setting up of an on-line sampling and analysis system in the gasifier plant. This information provides supporting data to more extensive laboratory analyses of process grab samples conducted at Oak Ridge National Laboratory (ORNL). To date, a minicomputer system has been installed and programmed to continuously collect analog temperature, flow, and pressure data from plant instruments. A process gas chromatograph system, an SO_2/NO/sub x/ analyzer, and continuous CO monitors are also being used to collect and work environment samples, and to record results on the computer. The computer software has been designed to ensure automatic data logging with a minimum of operator supervision, as well as providing data summary, data storage, and plotting routines. An on-site, bench-scale gas chromatograph has been installed to provide complete analyses of all gaseous grab samples. Liquid and solid analyses are being performed at ORNL. The collected data have been used to support the ORNL Health and Environmental Monitoring Program, including both industrial hygiene studies and site-specific assessments to detail impacts on health and environment and to determine the adequacy and efficiency of environmental and engineering controls. In addition, considerable, unforeseen, reliance has been placed on the installed monitoring capability by the gasifier plant operators. Preliminary information on the various process parameters of interest to the Health and Environmental Monitoring Program is presented. 10 figures.

49405 **(CONF-840971—5) Fossil Energy Technology Environmental Program information system: making the data accessible.** Gove, N.B.; Genung, R.K.; Huffstetler, J.; Oen, C. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001540.

From 1. annual Pittsburgh coal conference; Pittsburgh, PA, USA (17 Sep 1984).

The Fossil Energy Technology Environmental Program Program (FETEP) at Oak Ridge National Laboratory (ORNL) has reviewed publicly available literature on environmental, safety and health related research carried out as a part of or related to the Department of Energy's program on the direct liquefaction of coal with an emphasis on the projects in Ft. Lewis, WA. A series of documents has been written that summarize what has been learned and that suggests areas where further research may be warranted. As an integral part of the ORNL effort, a unique, computer-based information system has been designed and implemented. Information of various types and sources (e.g., published reports, chemical properties data banks, toxicity tabulations, internal reports) has been collected, analyzed, and made accessible. Ease of use was emphasized in designing the system. The user proceeds through a sequence of lists to select a topic of interest and is then able to search or browse information on that topic. Important references are carried in full; others are abstracted. Tabular displays are presented using a movable window, which can be adjusted to fit various interactive terminals. All entries may be retrieved via keywords, authors, sponsors, or synthetic fuel process. In addition, searches can be made on chemical name or biological test species. Available search methods and options are presented in menus to reduce the need for memorizing command formats. The system runs on the IBM computers at ORNL and can be accessed via a single command if the user has a terminal with telephone modem and a TSO account. Components of the system include INQUIRE, a commercially-available DBMS, ORLOOK, a local information retrieval program, CLIST, the IBM-TSO command language, plus locally-written PL/1 programs. 1 figure.

49406 **(KHM-TR—75) Effects of solid fuel fired plants for district heating. Air quality studies in two towns.** Olausson, L.; Levander, T.; Brostroem, C.E.; Timm, B.; Krieg, R.; Ryytty, C. (Statens Vattenfallsverk, Vaellingby (Sweden). Projekt KOL-HAELSA-MILJOE). Jun 1983. 192p. (In Swedish). NTIS (US Sales Only), PC A09/MF A01. File Number DE84751660.

Air quality studies have been accomplished for two typical Swedish towns. One study refers to a small town, Nykoeping, with 30000 inhabitants, and the other to a medium sized town, Oerebro, with 90,000 inhabitants. The aim of the study was to investigate the effects of solid fuel fired plants for district heating compared to the effects from individual heating and from traffic. During the 80s the district heating in the small town (Nykoeping) will expand and amount to some 100 MWth in 1990. The individual heating is decreased correspondingly. The medium sized town is thought to represent a community with an already existing district heating network where coal is used instead of oil as the main fuel. The system amounts to some 600 MWth. The results from the small town show

that replacing individual oil heating with solid fuel in a district heating system improves the air quality irrespective of the solid fuel used. The quantities of particulate matter in urban areas are, for the most part, due to dust, which is blown around with the wind and can be transported long distances. The motor traffic gives the second highest contribution. A changeover to district heating would improve the situation on condition that the plant is provided with an appropriate dust collection system. The results from the medium town, with an already existing district heating system, show that the situationwill be almost the same if oil or solid fuel is used.

49407 **(LA—10161-MS) Attenuation of chemical elements in acidic leachates from coal mineral wastes by soils.** Wangen, L.E.; Jones, M.M. (Los Alamos National Lab., NM (USA)). Aug 1984. Contract W-7405-ENG-36. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001513.

The chemical attenuation of acidity and selected elements (aluminum, arsenic, cadmium, cobalt, chromium, copper, fluorine, iron, manganese, nickel, and zinc) in acidic leachates from coal mineral wastes by four natural subsurface soils has been investigated by using laboratory column methods. Leachate solutions were allowed to percolate through the soils under simulated natural flow conditions, and the elemental concentrations in the influents and effluents were measured periodically. Elemental retentions were substantial for all species except manganese, which was eluted in excess from all soils except the most calcerous. Two processes appeared to operate in decreasing influent concentrations: (1) precipitation of solid phases caused by increased pH of the leachate as it percolated through the soil, and (2) adsorption of elements onto exchange and sorption sites naturally present in the soil and on iron and aluminum oxide precipitates formed in situ from leachate components because of the increased pH. The soil property most important in retention was its alkalinity. Thus, carbonaceous soils provide the best control material for acidic leachates from coal mineral wastes. Results show that natural soils can substantially reduce pollutant fluxes to the environment from acidic coal waste dumps and should be considered when selecting waste disposal sites. 9 references, 5 figures, 7 tables.

0110 Reserves And Exploration

49408 **(NP—5900040) Geologic map and mineral resources summary of the Sewanee Quadrangle, Tennessee.** Moore, J.L. (Tennessee Dept. of Conservation, Nashville (USA). Div. of Geology). 1983. 27p. Dept. of Conservation, 701 Broadway, Nashville, TN 37203 $2.00. File Number TI85900040.

This information packet consists of a small pamphlet and an accompanying map which describes the geology of the mineral resources of the Sewanee Quadrangle in Franklin and Grundy Counties. Possible resources consist of limestone, glass sand, shale and uneconomic coal deposits (Sewanee, Richland and Bon Air seams). The location of 109 coal prospects or, in many cases, abandoned coal mine sites are listed. (LTN)

0120 Mining

REFER ALSO TO CITATION(S) 01200049439, 49482, 50364

49409 **(BHRA—84/35) Water jet cutting of coal.** Saunders, D.H.; Blackwell, A. (British Hydromechanics Research Association, Cranfield). Jun 1981. 18p. (RR—1712). NTIS, PC $37.50.

This report gives details of a series of tests carried out using water jets to cut samples of British coal from different mines. The results obtained are compared with previously published work.

49410 **(BMFT-FB-T—84-177) Novel shield support for coal faces worked by shearer loaders in difficult geological conditions with modern ergonomic layout.** Schneider, W.J. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Ruhrkohle A.G., Essen (Germany, F.R.)). Aug 1984. 75p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE85750063.

An appropriate shield support system had to be developed and tested for the 200-280 cm thick coal bed N. Up until now it has not been possible to work the coal bed economically due to the thin accompanying coal beds O and M situated at short vertical distances in the roof viz. floor of coal bed N as well as due to the irregular sandstone intrusions. In the course of the project a 2-leg shield support unit equipped with retractable canopy extension was developed which allowed coal bed N, to be worked economically even in very difficult geological conditions, e.g. dip ranges up to 36 g, local through configurations in short sections of the face and up to 20 g rising in the working direction. The face was extracted with an optimum face support concept. Valuable know-how was obtained about forepoling which, generally speaking, may be transferred to the shield support concept in coal beds of less than 2.00 m thickness. Furthermore, during the project, the electro-magnetic by-pass control for retractable and extension roof bars as well as for coal face bumpers was purchased and tested which had been developed jointly by Messrs. Hemscheidt and Eickhoff. This approach oepns up a certain potential for automating the sequential control of shield support advancing.

49411 (CONF-830179—Vol.2, pp 57p, Paper 3) **How rapidly can production and use of eastern coal be expanded.** Perry, H. (Resources for the Future, Washington, DC). 1983. D. File Number TI84901918.

From Energy: challenges and opportunities for the Middle Atlantic United States symposium; Baltimore, MD, USA (10 Jan 1983).

Expanded production and use of domestic coal reserves have been a goal of US energy policy for several years. The policy was adopted to achieve security of energy supply (reduce oil imports) and provide energy requirements at lowest cost. Coal reserves of the US are very large and could satisfy US and world needs for many years. Coal can be used directly with other fuels in all markets except that used for transportation but it is at an economic, convenience and environmental disadvantage in the railroad, residential/commercial and small industrial markets. US coal exports have increased sharply in the past two years and still present a market opportunity for US coal producers. Coal is transported by rail, barge and truck - the mode used depending on availability and price. One coal slurry pipeline is in operation and others are planned. Coal export ports have experienced overcrowding but have enlarged their capacity and are currently operating without delays. While US coal productive capacity could be overtaxed for short periods and in limited geographic areas, there appear to be no overriding constraints to satisfying any foreseeable coal demand. However, meeting demand will require timely investments in the coal producing and transporting sectors and these would be immeasurably aided by stability in governmental policies and regulations. Absent such stability, undesirable delays could occur and costs could rise significantly.

49412 **(CONF-8306126—12) Physical and chemical problems with reclamation of conifers.** Stark, N. (Montana Univ., Missoula (USA). School of Forestry). 1983. 16p. ASAE, 2950 Niles Rd., St. Joseph, MI 49085. File Number TI85900077.

From American Society of Agricultural Engineers summer meeting; Bozeman, MT, USA (26 Jun 1983).

ASAE Paper No. 83-2142.

Saplings of ponderosa pine planted with a tree spade were set back because of compaction and smoothing of the sides of the hole. Seedlings grown as tubelings, bare root stock, or potted seedlings all have problems which hinder early development. Compaction from site preparation also creates a medium unsuited to tree seedling roots, even though larger trees would not be as adversely affected by compacted soil. Natural stands of ponderosa pine in eastern Montana grow either on deep sands, or rocky buttes. The rock layers retain water near the surface of the soil where the roots

are concentrated. A process of distillation-condensation concentrates water beneath the rocks near roots, and encourages precipitation of calcium as unavailable calcium carbonate which improves the chemistry of the soil near the roots. Recommendations are included relative to the laying of spoils (top- and subsoil) and their chemical and physical conditions for trees.

49413 **(CONF-8404196—1) Prospects for coal in America's energy future.** Hibbard, W.R. Jr. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Virginia Center for Coal and Energy Research). 28 Apr 1984. 6p. NTIS, PC A02/MF A01. File Number DE85900023.

From National Independent Coal Operators' Association annual meeting; Lexington, KY, USA (26 Apr 1984).

As for the longer range prospects for US coal, they will depend on the cost and availability of oil and natural gas. Crude oil imports rose 40 percent during the first quarter of 1984. Current projections for world oil prices, without incidents, are $29 a barrel through 1986. Then, a rise to $52 a barrel is anticipated by 1993, and to $92 a barrel by the year 2005. Natural gas prices are expected to rise as much as 20 percent in some areas, and range from 9 to 12 percent in others when controls are removed in January 1985. Analysts forecast a shortfall of US natural gas supplies for sometime in 1986 or 1987, when the current gas bubble is consumed. It is very likely that such a short fall might stimulate additional price increases at that time. Higher prices and limited domestic availability of these conventional fuels will stimulate the use of coal. Such prices will also revive the development of technology to economically convert coal to gaseous or liquid fuels. Most promising is a 70 percent fine coal, 30 percent water mixture which can be used in place of boiler fuel and, possibly, diesel fuel.

49414 **(EUR—8406) Environmental impact of the extraction, processing and utilisation of coal in the Federal Republic of Germany. Part 2. Brown coal.** (Commission of the European Communities, Luxembourg). 1983. 168p. (In German). (EUR—8406-DE). NTIS, PC E08/MF E08.

Starting from the base year of 1975, the trends in brown coal production and utilization are examined. Brown coal production in the RhineLand accounted for 85% of the total mined in 1975 and will probably account for 100% after 2000 A.D. It will be concentrated in fewer but larger open-cast mines since this is not only more economic but makes environmental protection easier to control. About 90% of brown coal production is used for electricity generation. Because new plants emits fewer pollutants than the old, emissions for a comparable electricity output should diminish as obsolete plant is shut down. Other brown coal uses seem set for a more dramatic change: briquette production is in decline but new markets are opening for brown coal dust and coke. However, all could be overshadowed by the late 1980s and mid 1990s by the economic significance of gasification and possibly of liquefaction. Since much depends on the movement of energy prices generally, it is impossible to predict future developments for brown coal with any certainty. It will, however, continue to be an important source of home-produced energy for the Federal Republic.

49415 **(PB—84-213511) Calamity Hollow Mine Fire Project. 3. Instrumentation for combustion monitoring, process control, and data recording. Report of investigations/ 1984.** Dalverny, L.E.; Chaiken, R.F.; Soroka, K.E. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). 1984. 31p. (BM-RI—8862). NTIS, PC A03/MF A01.

See also PB83-225417. Library of Congress catalog card No. 83-600025.

This report is the third in a five-part series that describes the Calamity Hollow Mine Fire Project. The first report, part 1, describes the design and construction of the field installation. Part 2 will present the results of a continuous 4-month burnout operation. (Because part 2 involves the analysis of a substantial body of data, it will not be published until after publication of parts 3, 4, and 5.) This part (part 3) describes the instrumentation used to control and monitor the progress of the burnout operation. Parts 4 and 5 both deal with the closeout phase of the field demonstration. Part 4 describes the procedure used to quench the fire, and part 5 will describe the final excavation and backfilling of the heated zones. The reports in this series document the Calamity Hollow controlled burnout demonstration which showed that (1) controlled in situ combustion is a feasible method for controlling underground fires in abandoned mines, (2) the resultant thermal exhaust output is sufficient for energy utilization, and (3) water injection with fume exhaustion (WIFE) is a potentially effective method for cooling large underground fire zones. Further trials of both Burnout Control and the WIFE quenching procedure are planned.

49416 **(PB—84-213735) Geologic factors in coal mine roof stability--a progress report. Information circular/1984.** Moebs, N.N.; Stateham, R.M. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). 1984. 34p. (BM-IC—8976). NTIS, PC A03/MF A01.

Library of Congress catalog card No. 84-600018.

This report summarizes 10 selected Bureau of Mines research contract reports produced from 1970 to 1980 which consist largely of geologic studies of coal mine roof support problems. Significant highlights from the contract final reports are discussed and presented in practical terms. The selected reports focus on the Appalachian and Illinois coal mining regions. In the Appalachian coal region, two geologic structures, roof rolls and slickensides, predominate over all structures as features that directly contribute to roof falls. Studies of these and other structures are reviewed, and improved methods of utilizing drill core and core logs to prepare hazard maps are presented. Among the reports described are several on the weakening effects of moisture on shale roof, as determined from both laboratory and underground measurements, and an assessment of air tempering as a humidity-control method. Also summarized are findings concerning the time lapse between roof exposure and permanent support installation as a factor in the effectiveness of roof bolting.

49417 **(PB—84-215052) Extension of low coal canopy technology to include drilling and cutting machines. Open file report 19 December 1980-15 June 1983.** Billmayer, H. (Wyle Labs., Huntsville, AL (USA)). 15 Aug 1983. 57p. NTIS, PC A04/MF A01.

Low coal canopies have been a source of controversy since their introduction into the mining industry. Canopies have been designed to protect the operator from roof falls and contact with the roof. In many cases, however, this protection has been achieved at the expense of operator visibility and ease of ingress and egress. The intent of this program was to improve the operator protection from numerous hazards and to improve the visibility, comfort, and ability to get in and out of the operator compartment without difficulty. Canopy hardware was built for a cutter and a face drill. Design improvements are described herein.

0130 Transport And Handling

REFER ALSO TO CITATION(S) 01300049378, 49383, 49411, 49414, 49435, 49961

49418 **(BHRA—84/43) Slurry pipeline cost analysis computer program.** Versteeg, H.K. (British Hydromechanics Research Association, Cranfield). Jan 1981. 17p. (TN—1652). NTIS, PC $37.50.

This report is concerned with the description of the work carried out to create a computer program capable of making preliminary order-of-magnitude cost estimates of hydraulic transportation systems with special reference to coal slurries. An outline is given of the estimating methodology adopted in general and more specifically in the individual parts of the program. Although a number of final modifications are still to be incorporated, it is expected that the program will provide a powerful management tool in the early stages of feasibility assessment. By means of sensitivity analysis it may be possible to identify areas in a slurry system project requiring special attention or research efforts.

49419 **(BMFT-FB-T—84-087) Microwave moisture-meter.** Klein, A. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Bergbau-Forschung G.m.b.H. Forschungsinstitut des Steinkohlenbergbauvereins, Essen (Germany, F.R.)). May 1984. 56p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE84752108.

On-Line Microwave Moisture-Meter for Coal Preparation Plants. On-line moisture determination penetrating fine grained coal with microwaves was tested on the plant using laboratory equipment. The best results are obtained measuring attenuation and phase, and the mass per area with a nuclear method if the thickness of the sample is varying. The prototype of an industrial moisture meter was developed. The system will be provided with a microprocessor.

49420 **(CHER—83-1) Entrainment/elutriation in fluidization and application in drying coal.** Ho, P.T.T. (Monash Univ., Clayton (Australia). Dept. of Chemical Engineering). 1982. 46p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85900263.

Industrial fluidized reactors operate with solids having a wide distribution of particle sizes, the fluidizing gas velocity, therefore, frequently exceeds the terminal velocity of the finer fractions and carries them out of the bed in the exit fluidizing stream. This loss of solids is, in general, undesirable for two reasons: First, high solid concentration in effluent gases of chemical plants is no longer permitted by air pollution restrictions. Second, losses due to entrainment can result in excessive operating costs, poor process economics, e.g., cost of catalyst loss, loss by advantages in bed performance that fines provide (for example, higher surfaces of fines are necessary to achieve high degrees of conversion and in acting as lubricants for larger particles, fines provide smooth fluidization, hence good gas and solid contacting). Consequently, entrained fines are recovered, normally with the installation of cyclones above the transport disengaging height (TDH), and returned to the dense phase bed. On the other hand, entrainment is found useful, e.g., in many diverse fluidized bed operations such as roasting, calcination, etc., the fines eventually require removal from the bed. The elutriation process involves the principle of separation by fractionation with a gas stream of varying velocity.

49421 (DOE/FE/60181—1642, pp 4.1-4.27) **Coal-water slurry preparation.** Baker, G.G.; Maas, D.J.; Potas, T.A.; Sears, R.E. Aug 1984. NTIS, PC A12/MF A01. File Number TI84017327.

In Low-rank coal research. Quarterly technical progress report, April-June 1984.

In summary, the hot-water drying process has proven to be an effective method of forming a highly-loaded, coal-water slurry fuel with the potential for gasification or combustion utilization. The slurry produced shows no evidence of significant moisture reabsorption or instability, thus making HWD CWS superior to CWS formulated with conventionally-dried or raw lignite. Also, the viscosity reduction realized with increased slurry temperature for the HWD CWS illustrates the opportunity to lower viscosities which may otherwise be considered excessive (approximately 800 to 1000 cps for a 60% BDS Indian Head lignite HWD CWS at room temperature) to more acceptable levels (300 to 500 cps at approximately 80°C). The aging studies show that exposure of the dried coal or filter cake to air or water at 30°C for up to 90 days did not significantly affect the moisture reabsorption properties as indicated by equilibrium moisture content. A preliminary economic study of the hot-water coal drying process to determine the incremental costs added to the selling price of lignite as a result of the drying process has been started. The study is aimed at sizing and costing a commercial-scale plant for hot-water drying North Dakota lignite. 16 figures, 12 tables.

49422 (DOE/FE/60181—1642, pp 9.1-9.22) **Fine coal cleaning.** Mitchell, M.J. Aug 1984. NTIS, PC A12/MF A01. File Number TI84017327.

In Low-rank coal research. Quarterly technical progress report, April-June 1984.

The goals for the Fine Coal Cleaning project are two-fold. The first is to support PETC in building a uniform data base on fine coal cleaning of western coals by float-sink methods. The second goal is to investigate advanced coal cleaning methods for selected low rank coals, with emphasis on upgrading the quality of low-rank coal/water slurries. The Pittsburgh Energy Technology Center is providing 156 coal samples for centrifugal float-sink analysis. Splits of coal, prepared to 65, 200 and 325 mesh top size will be separated at specific gravities of 1.3, 1.4, and 1.6. Washability studies on these same coal samples in the conventional size range are being performed in other PETC-funded projects. 4 tables.

49423 **(NP—4901797) Pilot Plant Program for the AED Advanced Coal Cleaning System. Phase II. Interim final report.** (Advanced Energy Dynamics, Inc., Natick, MA (USA)). Aug 1980. 91p. Dept. of Development, Div. of Energy, P.O. Box 1001, Columbus, OH 43216. File Number TI84901797.

Advanced Energy Dynamics, Inc. (AED), has developed a proprietary coal cleaning process which employs a combination of ionization and electrostatic separation to remove both sulfur and ash from dry pulverized coal. The Ohio Department of Energy sponsored the first part of a program to evaluate, develop, and demonstrate the process in a continuous-flow pilot plant. Various coals used by Ohio electric utilities were characterized and classified, and sulfur reduction, ash reduction and Btu recovery were measured. Sulfur removal in various coals ranged from 33 to 68% (on a Btu basis). Ash removal ranged from 17 to 59% (on a Btu basis). Ash removal of particles greater than 53 microns ranged from 46 to 88%. Btu recovery ranged from 90 to 97%. These results, especially the large percentage removal of ash particles greater than 53 microns, suggest that the AED system can contribute materially to improved boiler performance and availability. The study indicated the following potential areas for commercial utilization of the AED process: installation between the pulverizer and boiler of conventional coal-fired power utilities; reclamation of fine coal refuse; dry coal cleaning to supplement, and, if necessary, to take the place of conventional coal cleaning; upgrading coal used in: (1) coal-oil mixtures, (2) gasification and liquefaction processes designed to handle pulverized coal; and (3) blast furnaces for making steel, as a fuel supplement to the coke. Partial cleaning of coking coal blends during preheating may also prove economically attractive. Numerous other industrial processes which use pulverized coal such as the production of activated carbon and direct reduction of iron ore may also benefit from the use of AED coal cleaning.

49424 **High pressure liquid level monitor.** Bean, V.E.; Long, F.G. (to Dept. of Energy). US Patent 4,447,743. 8 May 1984. Filed date 28 Apr 1982. vp.

PAT-APPL-372861.

A liquid level monitor for tracking the level of a coal slurry in a high-pressure vessel including a toroidal-shaped float with magnetically permeable bands thereon disposed within the vessel, two pairs of magnetic field generators and detectors disposed outside the vessel adjacent the top and bottom thereof and magnetically coupled to the magnet[illegible]ally permeable bands on the float, and signal processing circuitry for combining signals from the top and bottom detectors for generating a monotonically increasing analog control signal which is a function of liquid level. The control signal may be utilized to operate high-pressure control valves associated with processes in which the high-pressure vessel is used.

0140 Combustion

REFER ALSO TO CITATION(S) 01400049378, 49388, 49389, 49390, 49391, 49752

49425 (CONF-830179—Vol.2, pp 19p, Paper 4) **Small coal furnaces: the neglected option.** Squires, A.M. (Virginia Polytechnic Inst. and State Univ., Blacksburg). 1983. D. File Number TI84901918.

From Energy: challenges and opportunities for the Middle Atlantic United States symposium; Baltimore, MD, USA (10 Jan 1983).

The United States burns nearly two million barrels per day of oil, on average, to provide space heat and hot water. Approximately 20 million furnaces use roughly one-half of this oil to meet residential heat needs. Another 620,000 small oil furnaces serve commerce and industry. An opportunity neglected in our Nation's energy planning has been to back out oil from these small furnaces by conversion to heat from direct combustion of coal. Modest targets might be to back out roughly 250,000 barrels per day, on average, from oil furances smaller than 117 kilowatts, and roughly an-

other 250,000 barrels per day from oil furnaces between 117 kilowatts and ca. 7.3 megawatts. Meeting both targets would call for production and distribution of roughly 40 million additional tons per year of coal.

49426 **(DOE/ET/13617—T1) Fluidization 1980 conference: [summary of workshop discussions].** Matsen, J.M.; Grace, J.R. (comps.). (Engineering Foundation, New York (USA)). 4 Dec 1980. Contract FG01-80ET13617. 39p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85000567.

The 1980 International Conference on Fluidization was held at New England College, Henniker, NH, August 3-8, 1980. This report gives the titles and authors of the papers given, a list of participants and short summaries of workshop discussions in 10 specific areas. (LTN)

49427 (DOE/FE/60181—1642, pp 8.1-8.9) **Waste characterization.** Henke, K.R.; Sears, D.R. Aug 1984. NTIS, PC A12/MF A01. File Number TI84017327.

In Low-rank coal research. Quarterly technical progress report, April-June 1984.

One element which seems to display a generic tendency to leach at significant concentrations from pc-fired ashes is boron. Boron is not a RCRA element and currently there are no drinking water standards for the element. However, there are long- and short-term irrigation criteria. These are based on relative tolerances of plant species to boron. Generally speaking, small grains and vegetable row crops are listed as semi-tolerant or tolerant to boron; fruits and nuts, not widely cultivated in northern plains coal fields, are said to be sensitive to boron. The semi-tolerant species are those which display slight to moderate injury at boron levels of 1.0 to 2.0 mg/l, and tolerant crops at levels of 2.0 to 4.0 mg/l. The margin between nutrient levels and harmful levels is said to be small, although this may depend upon soil types (4). It is possible that irrigation waters might be drawn from undrained impoundments at mined-out areas down the hydraulic gradient from ash disposal sites. For this reason, boron needs continuous surveillance since its ash leachate concentrations often exceed long-term irrigation criteria by factors of 4 to 140. 7 references, 5 tables.

49428 (DOE/FE/60181—1642, pp 10.1-10.17) **Combustion research and ash fouling.** McCollor, D.P.; Jones, M.L.; Kinneman, W.P. Aug 1984. NTIS, PC A12/MF A01. File Number TI84017327.

In Low-rank coal research. Quarterly technical progress report, April-June 1984.

The combustion research and ash fouling project has two primary objectives. The first is the development of fundamental data and correlations on the combustion reactions of low-rank coals. This information will be generated over a range of particle sizes, reaction atmospheres, and temperatures representative of the combustion process. Special attention will be given to effects related to the unique properties of low-rank coals such as high moisture content, lower heating value, highly variable and alkaline ash, and high porosity. The second objective is to examine mineral matter transformations in low-rank coal combustion systems. Part of this effort will involve expansion of the technical data base at UNDERC on ash fouling and slagging in pc cyclone furnaces burning LRCs. Additional work will deal with the mineral matter transformations occurring in combustion environments. This will include both laboratory studies and modifications to pilot-scale devices allowing for a more complete description of mineral matter as it moves through the combustion system. 7 figures, 3 tables.

49429 (DOE/FE/60181—1642, pp 11.1-11.7) **Fluidized bed combustion of low-rank coals.** Hajicek, D.R. Aug 1984. NTIS, PC A12/MF A01. File Number TI84017327.

In Low-rank coal research. Quarterly technical progress report, April-June 1984.

The Fluidized Bed Combustion project at the University of North Dakota Energy Research Center has three major goals: (1) to resolve identified problems such as bed agglomeration, low turndown ratio, and enhanced utilization of SO/sub x/ sorbents; (2) to continue the development of a data base on the FBC process and systems utilizing low-rank coals; and (3) to develop advanced AFBC concepts for use with low-rank coals. Specific objectives are: (1) the evaluation of agglomeration formation, including the effects of different coal feed methods on bed material agglomeration, obtaining more representative bed samples by the use of a bed sampling probe, the performance of laboratory studies to better understand agglomeration formation, and based upon laboratory results, the demonstration of sodium forms on bed agglomeration on the 2.25 sq. ft. AFBC; (2) the design and construction of a second generation pilot scale fluid bed combustor that will beneficially utilize the characteristics of low-rank coals; (3) the determination of the radiative component of the heat transfer coefficient for in-bed heat transfer tubes; (4) the comparison of PFBC data from New York University to AFBC data on similar low-rank coals; and (5) the completion of a technology base report on the performance of low-rank coal in Atmospheric Fluidized Bed Combustion. 4 figures.

49430 (DOE/FE/60181—1642, pp 12.1-12.6) **Low-rank coal/water slurry combustion.** Hauserman, W.B. Aug 1984. NTIS, PC A12/MF A01. File Number TI84017327.

In Low-rank coal research. Quarterly technical progress report, April-June 1984.

Preliminary data from GFETC/UND studies indicate that hot-water drying shows potential as a viable technique to prepare low-rank coals for slurry combustion. In addition to removing moisture, removal of sodium and/or sulfur has been noted in lignites dried by this process. The dried coal appears to have a lower bulk density which may be contributing to the increased stability noted with suspensions prepared by hot-water drying. No prior work has been done, to our knowledge, on combustion of low-rank coal/water slurries that have been subjected to hot-water drying. The specific goals of the project for the second cooperative agreement year are: (1) evaluate the initial results of bench-scale combustion testing by BYU of low-rank coal/water slurries provided by UNDERC; (2) design, construct, and evaluate a pilot scale low-rank coal/water slurry combustion system by modification of the existing UNDERC ash fouling furnace; and (3) operate the pilot combustion system to characterize and compare performance of various commercial (bituminous) and UNDERC-produced (lignite) slurries with alternative hardware components. 4 figures.

49431 (DOE/FE/60181—1642, pp 13.1-13.7) **Ash and slag characterization.** Falcone, S.; Braun, S. Aug 1984. NTIS, PC A12/MF A01. File Number TI84017327.

In Low-rank coal research. Quarterly technical progress report, April-June 1984.

The goal of the Ash and Slag Characterization project is to develop a fundamental understanding of the properties and behavior of the inorganic constituents of low-rank coals at high temperatures. The project is therefore directed at studying the chemical changes occurring when low-rank coals are ashed and at measuring thermophysical properties of the resulting ashes and slags, with observed chemical changes or measured data then correlated with the chemical and mineralogical composition of the inorganic species in the coal. The objectives of the Ash and Slag Characterization project during this reporting period were to continue work on several activities: collection of samples of low-rank coals; ashing and slagging of low-rank coal samples under controlled laboratory conditions, with attendant chemical and mineralogical analyses of the ashes; development of further understanding of mineral transformations during ashing by heating synthetic ash mixtures and development of an apparatus to measure surface tension of slags. 2 tables.

49432 (DOE/METC—84-6, pp 367-383) **Chemical effects of entrained particles in coal conversion streams: prediction of PFBC alkali levels.** Stinespring, C.D.; Annen, K.D.; Frankel, D.S.; Stewart, G.W. (Aerodyne Research, Inc., Billerica, MA). Dec 1983. NTIS, PC A21/MF A01. File Number DE84000216. (CONF-8305112—).

From 3. annual contractors' meeting on contaminant control in hot coal derived gas streams; Washington, PA, USA (24 May 1983).

The overall objective of this program is to provide the theoretical and experimental basis required to predict the levels of alkali species in PFBC systems and to analyze the effects of prototype cleanup devices. To this end, a physical model describing the partitioning of alkali species between the interior, the surface, and the

gas phase surrounding particles has been developed. This model includes the processes of surface segregation, evaporation, and adsorption and may be used to calculate particle surface composition, depth profiles, average particle composition, and vaporization rates as a function of time and temperature. In addition, vaporization and segregation studies for Na and K in aluminosilicate ash and ash-like materials have been performed to provide necessary input data for the model. These experimental and theoretical results, along with input data from the Curtiss-Wright test facility, have been used to predict the levels of gas phase alkali species released from aluminosilicate ash in PFBC systems. The results of these calculations indicate that gas phase alkali levels resulting from the aluminosilicate ash are well below those predicted by equilibrium techniques for typical PFBC operating conditions. That is, most of the alkalis associated with the ash are retained by the ash. Moreover, because of segregation processes, the surfaces of these ash particles will be enriched in alkalis (relative to the average bulk concentration). Thus, gas-surface reactions rather than gas phase reactions may be responsible for the formation of corrosive alkali-sulfur compounds. 21 references, 13 figures.

49433 **(NP—4901791) Stoker test evaluations using clean pellet fuel.** Marlowe, W.H.; Brody, C.W.; Ban, T.E.; Nelson, C.J. (McDowell-Wellman Co., Cleveland, OH (USA). Dwight-Lloyd Research Labs.). Oct 1980. 186p. Dept. of Development, Div. of Energy, P.O. Box 1001, Columbus, OH 43216. File Number TI84901791.

A chain-grate stoker at the powerhouse of the Ohio State Reformatory was modified for use of clean pellet fuel for combustion demonstrations. Clean pellet fuel for the Mansfield tests was prepared from a series of production test runs at the Cleveland Research Center using relatively high sulfur industrial coal ranging from about 3.1 to 4.5% sulfur. Accordingly, pellets of a relatively high sulfur content were produced. Also, sulfur fixation in the pellets for the Mansfield tests was not as extensive as that from the Massillon tests. Subsequent small scale bench tests and prior pilot plant tests showed how this could be improved if necessary by use of alkaline additions. Table A provides a summary of modifications made on the Mansfield stoker along with the outcome and general observations. Through the use of the developed firing system stack conditions invariably remained free of visible emissions and black, sooty type smoke was not observed, verifying the smokeless nature of the fuel. Optimum conditions apparently exist for (a) ideal ignition, (b) sulfur emission minimization, and (c) particulate emission minimization. These reported test runs had the primary objective of demonstrating the capability of the fuel to continuously ignite and fire using a stoker-boiler designed for normal bituminous coal operating under a range of firing conditions. This was adequately demonstrated; however, the test runs were of insufficient duration to attain optimum firing conditions for all environmental control measures. Nevertheless, extensive sulfur and particulate arresting was evident and compliance conditions are attainable for more than about 75% of the counties of Ohio using coal that exceeds 3 1/2% sulfur for production of clean pellet fuel.

49434 **Analytical model for freeboard and in-bed limestone sulfation in fluidized-bed coal combustors.** Fee, D.C.; Myles, K.M.; Marroquin, G.; Fan, L.S. (Argonne National Lab., IL). *Chemical Engineering Science;* **39**: No. 4, 731-737(1984).

A new model, which combines in-bed and freeboard sulfation, significantly improves the ability to predict sulfur capture by limestone sorbents in fluidized-bed coal combustors. In this model, the in-bed hydrodynamics are described in terms of a bubble phase and an emulsion phase while the freeboard region has only a diluted emulsion phase. The solids, which are in the emulsion phases, are considered to be completely back-mixed; the gaseous bubble phase travels in plug-flow but exchanges with the emulsion phase. The sulfation reaction occurs principally in the emulsion phase and the reaction rate is a direct function of the sulfur dioxide concentration, the extent of the calcium oxide conversion (as measured by a thermogravimetric analyzer), and the amount of limestone present in the bed and in the freeboard. The amount present, or holdup, in the free-board is calculated from empirical correlations for elutriation and from particle-time trajectories as predicted from equations of motion. 19 references, 4 figures.

0150 Marketing And Economics

REFER ALSO TO CITATION(S) 01500049413

49435 **(DOE/EIA—0125(84/2Q)) Coal distribution, January-June 1984.** McNair, M.B. (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). Oct 1984. 96p. NTIS, PC A05/MF A01 - GPO; GPO Dep. File Number DE85001244.

This report presents information on coal distribution by coal-producing district, consumer use, and method of transport. All data in this report are preliminary for 1984 and final for 1980 to 1983. Data are included for: coal production and purchases; distribution by origin, destination, and consumer, and method of transport; and domestic distribution of US coal to electric utilities. Production and/or purchases of coal in the US from January through June, 1984 totaled 447.9 million short tons; coal stocks totaled 30.8 million short tons; and coal distributed totaled 450.6 million short tons. Of the coal distributed, 407.8 million tons went to US consumers (337.9 million to electric utilities, 26.9 million to coke plants, 37.6 million to other industrial consumers, 4.3 million to residential/commercial consumers, and 2 thousand to the transportation sector). Railroads were the principal mode of transport. The leading state to receive coal was Texas, followed by Ohio, Pennsylvania, and Indiana. 33 tables. (DMC)

49436 **(DOE/EIA—0333(84)) Annual outlook for US coal, 1984: with projections to 1995.** Paull, M.K. (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). Oct 1984. 46p. NTIS, PC A03/MF A01; 1 - GPO; GPO Dep. File Number DE85001705.

This report elaborates on the projection that coal use will increase, and discusses some of the factors, and current issues that could affect this growth and the coal industry. Some of these factors are: federal coal leasing, transportation systems, coal exports, amendment of the Clean Air Act, and the availability of certain coal. Data show the historical change in primary fuel consumption from 1965 to 1980 and the projected change from 1980 to 1995. As in the recent past, the electric utility sector is projected to be the major consumer of coal, accounting for 86% of total US coal consumption by 1995, up from 81% in 1980. The industrial sector consumed 18% of all coal consumed in 1980. Industrial demand for coal is expected to decrease by about 1% per year between 1980 and 1985, but to increase by about 1.5% per year between 1985 and 1995. Coal used to produce coke (metallurgical coal) is projected to decline approximately 1.7% a year between 1980 and 1995, reflecting technological changes in steelmaking and reduced steel output. Coal export markets are expected to experience growth over the forecast period as the world demand for coal increases. Over the forecast period, coal production is expected to increase from 830 million short tons in 1980 to 1045 million short tons in 1990 and to 1191 million short tons in 1995. By 1995, about 39% of US coal production (compared with 30% in 1980) is projected to come from states west of the Mississippi River. Since 1973, coal production on federally owned lands (almost all in the West) has nearly quadrupled. Constraints for increasing coal production are discussed. 41 references, 5 figures, 9 tables.

49437 **(GAO/RCED—84-17) Legislative changes are needed to authorize emergency federal coal leasing.** Bowsher, C.A. (General Accounting Office, Washington, DC (USA). Office of the Comptroller General). 2 Aug 1984. 53p. US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760. File Number TI85900085.

The Department of the Interior has established emergency leasing regulations to make federal coal available to existing operators with an urgent need for it. Existing law requires the Secretary of the Interior to issue federal coal leases, including emergency leases, on a competitive basis. Although reasonable in concept, Interior's emergency leasing regulations have been difficult to administer within a competitive framework, mainly because there is an inherent lack of competitive interest for emergency tracts which are located next to an ongoing mining operation and are needed to

sustain it. The low value of these tracts on the open market contrasts with their substantial economic value to the adjacent operator needing the coal. In view of the need for emergency leasing, GAO recommends that the Congress amend the Mineral Lands Leasing Act of 1920 to authorize emergency federal coal leasing and to allow Interior to use negotiated, rather than competitive, lease sale procedures to carry it out. Such legislative changes would recognize the unique objectives of emergency leasing and allow Interior to administer it in a more pragmatic manner. 1 table.

49438 **(GAO/RCED—84-46) Synthetic Fuels Corporation's progress in aiding synthetic fuels development.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 11 Jul 1984. 33p. US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760. File Number TI85900198.

Report to the Chairman, Subcommittee on Fossil and Synthetic Fuels, Committee on Energy and Commerce, House of Representatives.

It has been difficult for the Corporation to make progress toward the goals of the Energy Security Act of June 1980 because of the changing economic and energy conditions. Relative to the 1987 production goal of 500,000 barrels of crude oil equivalent per day, the Corporation had awarded contracts for two projects expected to have a total production equivalent of 9500 barrels of crude oil per day. Including these two projects, the Corporation has said that it plans to award by early 1985 up to $14.8 billion in financial assistance for about 12 projects representing a diverse range of technologies, which would have a combined total production of about 132,000 barrels of crude oil equivalent per day. These plans may be affected by a recent administration proposal to rescind $9 billion of the Corporation's remaining unobligated funds. Private industry officials said that synthetic fuels projects have been abandoned or postponed primarily because of an unfavorable economic climate, a world oil glut that has caused declines in crude oil prices, the uncertainty of future crude oil prices, and the large capital investment needed for project construction. These officials also said that 1982 tax legislation, by reducing the after-tax return on investment, has also caused industry to abandon or delay going forward with synthetic fuels projects.

0160 Health And Safety

REFER ALSO TO CITATION(S) 01600049405, 49417, 50637

49439 **(BMFT-FB-HA—84-021) Technical equipment for rescuing injured miners in case of roof breaks in coal faces and roadways.** Zillessen, C. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Ruhrkohle A.G., Essen (Germany, F.R.)). May 1984. 68p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE84752107.

The project goal was to develop a "rescueing system" allowing to faster rescue injured miners in case of roff breaks in coalfaces and roadways. Had also to be created the basis for mechanizing previously manual rescue activities. Appertaining literature in Germany and abroad, whilst describing rescue drilling operations, do not give any useful hints how to mechanize penetration into roof break areas in faces or roadways. Development work was thus centered on the following issues: - Efficient cutting through rock from roof breaks. - Protection of the rescueing squad from falling rock. - Reduction of foreign matter hampering heading operations. The newly developed rescueing system consists mainly of a cutting shield, integrated scrab-type loader, sraper conveyor, and discretionally extensible support tube. A crawler-mounted crab-type loader was to complete the rescueing equipment in special conditions. Whilst the different sub-elements passed the functional test successfully the integrates system did not prove useful during a simulated emergency. Unsolved procedural issues, numerous technical deficiencies and excessive mounting times helped to miss the project goal. Nonetheless different sub-elements, e.g. the support tube, may enhance the efficiency of conventional rescueing operations.

49440 **(CONF-811236—5) Methodology for comparing the health effects of electricity generation from uranium and coal fuels.** Rhyne, W.R.; El-Bassioni, A.A. (H and R Associates, Inc., Oak Ridge, TN (USA); Nuclear Regulatory Commission, Washington, DC (USA)). 08 Dec 1981. Contract AC05-84OR21400. 27p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85000962.

From Workshop on assessing health impacts of energy technologies at the regional or national levels; Upton, NY, USA (7 Dec 1981).

A methodology was developed for comparing the health risks of electricity generation from uranium and coal fuels. The health effects attributable to the construction, operation, and decommissioning of each facility in the two fuel cycle were considered. The methodology is based on defining (1) requirement variables for the materials, energy, etc., (2) effluent variables associated with the requirement variables as well as with the fuel cycle facility operation, and (3) health impact variables for effluents and accidents. The materials, energy, etc., required for construction, operation, and decommissioning of each fuel cycle facility are defined as primary variables. The materials, energy, etc., needed to produce the primary variable are defined as secondary requirement variables. Each requirement variable (primary, secondary, etc.) has associated effluent variables and health impact variables. A diverging chain or tree is formed for each primary variable. Fortunately, most elements reoccur frequently to reduce the level of analysis complexity. 6 references, 11 figures, 6 tables.

49441 **Lung-clearance classification of radionuclides in coal fly ash.** Kalkwarf, D.R.; Jackson, P.O.; Hardin, J.M. (Pacific Northwest Lab., Richland, WA). *Health Physics;* **47**: No. 1, 37-45(Jul 1984). Contract AC06-76RL01830.

Lung-clearance classifications for ^{238}U, ^{232}Th, ^{230}Th, ^{228}Th, ^{226}Ra, ^{210}Pb, and ^{210}Po in respirable coal fly ash were estimated for use with the lung clearance model proposed by the ICRP Task Group on Lung Dynamics. Estimates were based on measurements of the dissolution rates for these radionuclides from sized fly-ash samples into simulated lung fluid at 37°C. The estimates were expressed in the classification terms of the model, i.e. D, W, and Y, indicating lung clearance half-times of 0-10 days, 11-100 days, and more than 100 days, respectively. Ash from eastern bituminous coal, western bituminous coal and mid-western bituminous coal was examined. Both Class-D and Class-Y components of ^{238}U were found in all samples, whereas all the other radionuclides dissolved very slowly and were classified 100% Class Y.

0170 Legislation And Regulations

REFER ALSO TO CITATION(S) 01700049437

49442 **(DOE/EV/10472—T7) Analysis of proposed changes to federal surface mining and coal leasing policy.** (Rogers, Golden and Halpern, Inc., Philadelphia, PA (USA)). Aug 1982. Contract AC01-81EV10472. 71p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85000727.

This report summarizes and evaluates a number of recently proposed changes by Congress, the Reagan Administration and others to the Surface Mining Control and Reclamation Act (1977) and the Federal Coal Management Program (1979). The potential impacts of these proposed changes are discussed and an analytical model is developed and applied to investigate the regional impacts of alternative proposals. 65 references, 7 figures, 14 tables.

02 PETROLEUM

49443 **(NP—4751650) Annual report 1981.** (Oljedirektoratet, Stavanger (Norway)). 1982. 246p. NTIS (US Sales Only), PC A11/MF A01. File Number DE84751650.

The first chapter concerns the Directorates task, board of directors and management. The main part of the report deals with drilling and production activity on the Norwegian continental shelf, safety control, petroleum economics, and the recovery of petroleum deposits and future prospects. Geophysical and geological surveys, exploration and appraisal wells, finds and fields being evaluated are

included. Details such as concession holders, production facilities, recovery of reserves, metering system and costs are treated for the following fields: Valhall, the Ekofisk area, Ula, Heimdal, the Frigg area, 34/10 Delta East Phase I, the Statfjord area and Murchinson. Included are also chapters on safety and preparedness research, international cooperation and two technical papers (Economic field evaluation, and Noise on offshore facilities). The last chapter contains statistics on production of oil and gas, royalties, petroleum markets, prices and tarriffs. 68 figures, 41 tables.

0201 Reserves

REFER ALSO TO CITATION(S) 02010049951

49444 **(CONF-830682—4) Experiment to evaluate methods for estimating fossil fuel resources.** Sterman, J.D.; Richardson, G.P. (Massachusetts Inst. of Tech., Cambridge (USA). Alfred P. Sloan School of Management; Wheaton Coll., Norton, MA (USA)). Apr 1983. 69p. Massachusetts Institute of Technology, 50 Memorial Drive, Cambridge, MA 02139. File Number TI85900006.

From 3. international symposium on forecasting; Philadelphia, PA, USA (5 Jun 1983).

Estimates of petroleum and natural gas resources vary substantially, both over time and across estimation methods. Worse, no reliable method exists for evaluating the accuracy of the various methods for estimating resources. This paper develops a simulation model of an exhaustible resource to evaluate different resource estimation techniques. Protocols for the Hubbert life cycle and USGS geologic analogy methods are developed and applied to synthetic data generated by the model. It is shown that the Hubbert method can generate an accurate estimate as early as twenty years before the peak of global production, but the geologic analogy approach overshoots the true resource base over the life cycle of the resource. 53 references, 17 figures, 3 tables.

0202 Geology And Exploration

49445 **Facies relationships and reservoir potential of Ohio Creek interval across Piceance Creek basin, northwestern Colorado.** Rutledge, A.K.; Lorenz, J.C. (Sandia National Laboratories, Albuquerque, NM). *American Association of Petroleum Geologists, Bulletin;* **68**: No. 4, 524(Apr 1984). (CONF-8405216—).

From AAPG annual convention; San Antonio, TX, USA (20 May 1984).

The Ohio Creek member of the Mesaverde Group of Late Cretaceous age grades from a fluvial to a paralic facies from the southern to central parts of the Piceance Creek basin. The Ohio Creek is considered here to be the nonmarine to paralic equivalent of the Lewis transgression to the north. Although it is fluvial in the type area and southern part of the basin, evidence of marine influence in the east central part of the basin includes: (1) zones of abundant logs with large fossil Teredinidae burrows, (2) palynological evidence from outcrops at Rifle Gap and the US Department of Energy MWX wells, and (3) marine-type sedimentary structures visible in outcrop. In this east-central area Ohio Creek depositional environments are interpreted as distributary channel and estuarine. Although the Ohio Creek is highly altered by diagenesis and is an aquifer in some parts of the basin, the equivalent zones are productive of hydrocarbons in the north-central parts of the basin. Continued changes in facies toward a marine environment to the north affected the petrologic characteristics and sand body/reservoir morphology, increasing the reservoir potential of this zone to the north. The variably thick interval is recognizable in the subsurface as an extensive sandy zone with blocky shaped log profiles; it should provide good reservoirs where porosity and permeability are not occluded by diagenesis, and where continuity with surface exposures has not allowed gas escape and water influx.

0203 Drilling And Production

REFER ALSO TO CITATION(S) 02030049951, 50436

49446 **(DOE/BC/10033—10) Project evaluation: Penn Grade Micellar Displacement Project.** Suffridge, F.E. (Keplinger and Associates, Inc., Tulsa, OK (USA)). Oct 1984. Contract AC19-80BC10033. 40p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84012730.

The Penn Grade Micellar Displacement Project tested the micellar/polymer flooding process in a low permeability portion of the Bradford Third Sand reservoir. This test, herein referred to as the Lawry Test, followed the successful test of the micellar/polymer flooding process in a higher permeability portion of the Bradford Third Sand reservoir (Bingham Test). The Lawry Test failed technically and economically as an oil recovery process. Total oil recovery amounted to about 5.2% of the oil-in-place at the time of micellar injection. Project failure did not appear to be the reusult of poor operational practice. Project participants recognized the difficulty of applying the micellar/polymer process in such a low permeability reservoir at the initiation of the project. Nevertheless, the large reserve of oil trapped within the low permeability portions of the Bradford Field made the project attractive. There appeared to be three major reasons for project failure: (1) reservoir heterogeneity; (2) adverse ion exchange phenomena; and (3) high sulfonate loss. Data from Phase I testing, injection well tracer surveys, injection well logging, produced chloride concentrations and the Phase II evaluation well confirmed that only a small portion of the Lawry pilot was contacted by injected fluids. Produced salinity and hardness levels suggested the occurrence of adverse ion exchange phenomena. Adverse ion exchange behavior would be expected to have resulted in severe sulfonate loss, and low oil recovery. Additional data are needed to confirm this conclusion. In addition, injectivity was low throughout the project. In the absence of the above problems, it is likely that the process would not be practical in areas typical of Lawry because of low injectivity. 10 references, 12 figures, 12 tables.

49447 **(DOE/BC/10321—16) Improved polymers for enhanced oil recovery synthesis and rheology. Sixth annual report, October 1982-September 1983.** McCormick, C.L.; Hester, R.D. (University of Southern Mississippi, Hattiesburg (USA). Dept. of Polymer Science). 1983. Contract AS19-80BC10321. 150p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE85000105.

During the six years of our research endeavors, several fundamental concepts have been probed which now allow synthesis and characterization of polymers with properties which may be of much greater value than those presently utilized in Enhanced Oil Recovery. In the previous annual report, we documented improved salt tolerance and phase behavior of random and graft copolymers of acrylamide (AM) with sodium-2-acrylamido-2-methylpropane sulfonate (NaAMPS). This report focuses upon synthesis characterization, and solution properties of random and graft copolymers of AM with diacetone acrylamide (DAAM). These polymers at certain compositions exhibit the unusual characteristic of increased hydrodynamic volume with added NaCl or $CaCl_2$. Additionally, we report analytical techniques developed through FY 1983 in our laboratories for the challenging study of water-soluble polymers of high molecular weight. Specific studies reported are: (1) copolymers of acrylamide with N-(1,1-dimethyl-3-oxybutyl) acrylamide and N,N-dimethylacrylamide - synthesis and characterization; (2) copolymers of acrylamide with N-(1,1-dimethyl-3-oxybutyl) acrylamide and N,N-dimethylacrylamide - solution properties; (3) selectivity in the graft copolymerization of acrylamide/N-(1,1 dimethyl-3-oxybutyl) acrylamide comonomers onto dextran by Ce(IV)-induced initiation; (4) selectivity in graft copolymerization of acrylamide/N-(1,1 dimethyl-3-oxybutyl) acrylamide comonomers onto dextran by Ce(IV)-induced initiation; (5) determination of molecular mass and hydrodynamic properties of several partially hydrolyzed polyacrylamides; (6) deconvolution of overlapping chromatograms using constrained non-linear optimization; and (7) pressure detectors for aqueous size exclusion chromatography.

49448 **(DOE/MC/16551—14) Enhanced oil recovery by CO_2 foam flooding. Quarterly report, July 1-September 30, 1984.** (New Mexico State Univ., Las Cruces (USA). Dept. of Chemical Engineering). 2 Oct 1984. Contract AC21-81MC16551. 4p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000345.

Accomplishments for this quarter are presented for the following tasks: apparatus design and construction; foam generation and static stability; dynamic foam stability; foam stabilizer; miscible displacement; and computer simulation. Work on the project proceeded satisfactorily in all phases. A summary paper describing the results of the project has been accepted for presentation at the third European Congress on Enhanced Oil Recovery and the manuscript is in preparation. Interest and support from the petroleum industry remains high. During the past quarter samples of crude oil from current field operations were submitted by Phillips Petroleum Company and Conoco Inc. so that laboratory experiments can be extended to actual candidate oils now being flooded commercially. Both oils represent reservoirs in Southeastern New Mexico and will complement earlier studies already completed on California crude oils.

49449 **(OCS/MMS—84-0030) Outer Continental Shelf oil and gas activities in the Gulf of Alaska and their onshore impacts. Gulf of Alaska summary report update, May 1984.** Wiese, J.D. (Rogers, Golden and Halpern, Inc., Reston, VA (USA)). May 1984. 26p. OCS, Information Program, 12203 Sunrise Valley Drive, MS 640, Reston, VA 22091. File Number TI84901875.

The Gulf of Alaska Summary Report and its revisions and updates cover OCS-related development in the Gulf of Alaska Subregion. This subregion is composed of four OCS planning areas, specifically Gulf of Alaska, Cook Inlet, Kodiak, and Shumagin. Lease sales on the OCS have been scheduled by the Department of the Interior (DOI) for the Kodiak and Shumagin Planning Areas - in 1986 and 1987, respectively - and this update includes whatever information presently is available for these planning areas. However, the primary geographic focus of this update is the Gulf of Alaska and Cook Inlet Planning Areas where lease sales have already been held. Oil and gas have been produced from State waters of the Cook Inlet for many years. There has, however, never been a commercial discovery on any portion of the OCS of the Gulf of Alaska Subregion. Each of the 12 exploratory wells drilled on the OCS of the Gulf of Alaska and the 10 wells drilled in the Lower Cook Inlet have resulted in dry holes. These wells have since been plugged and abandoned, and the leases under which the drilling occurred have been relinquished. At present, there are not announced industry plans to explore further the active leases in the Gulf of Alaska. Chevron USA, Inc., received approval for two separate plans of exploration covering one block in the Lower Cook Inlet and two blocks in the Shelikof Strait. Chevron has tentative plans to drill under these POE's in the second half of 1984. This exploration will be carried out from onshore facilities that were used during previous drilling efforts, particularly the Kenai facilities. Unless Chevron's exploration plans are successful, the level of exploration activity in the Gulf of Alaska Subregion is not likely to change until after OCS Lease Sale 88, scheduled for December 1984, is held. 9 references, 4 figures, 5 tables.

49450 **(STF—28A83007) Gas injection in heterogeneous reservoirs. Analytical solution No. 1.** Jelmert, T.A. (SINTEF, Trondheim (Norway)). Jun 1983. 91p. NTIS (US Sales Only), PC A05/MF A01. File Number DE84751647.

The present report deals with the displacement of an undersaturated liquid by gas in a heterogeneous reservoir. A new double porosity mathematical model is proposed. Oil is expelled from the tight zones as a consequence of a diffusion/swelling process. An analytical solution to the resulting equations is provided. The derived equations provides a practical tool for predictive calculations on the effect of gas injection operations in heterogeneous reservoirs containing tight zones of a small to medium sized characteristic dimension. The approximate analytical solution includes a previous solution for two-phase flow of water and oil as a special case. In addition the static solution obtained by material balance calculations, is approached symptomatically with increasing time.

49451 **(STF—28A83012) Gas injection in heterogeneous reservoirs. Case study No. 1.** Jelmert, T.A. (SINTEF, Trondheim (Norway)). Jun 1983. 37p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84751648.

The present report deals with the displacement of an undersaturated liquid by gas in a heterogeneous reservoir. Oil is expelled from the tight zones as a consequence of a diffusion/swelling process. The purpose of this study is to apply a previously proposed analytical solution to predictive calculations at field scale. The theory is developed further and the results obtained are compared with results from independant numerical models. The effect of the number of the high permeability zones on the gas break-through time is investigated. 6 figures, 6 tables.

49452 **Results of the Bell Creek Unit "A" micellar-polymer pilot.** Aho, G.E.; Bush, J. *SPE (Society of Petroleum Engineers of AIME) Reprint Series;* **57**: vp(1982). (CONF-820927—).

From 57. AIME Society of Petroleum Engineers annual technical conference and exhibition; New Orleans, LA, USA (26 Sep 1982).

Gary Energy Corporation has conducted a DOE cost-shared micellar-polymer pilot in the Bell Creek Field, Powder River County, Montana. Unexpected reservoir heterogeneity in the pilot area and the delivery of less-than-design quality sulfonates appear to have affected the chemical flood efficiency. Oil recovery in the confined portion of the pilot is expected to be 28% of the oil-in-place at the start of process injection. Approximately 40% of this recovery is considered to be incremental tertiary. A summary of all aspects of the pilot is presented, including reservoir geology, chemical flood process design, computer simulation studies, process injection, oil treatment problems, and an analysis of overall project performance. 12 references.

0204 Processing

REFER ALSO TO CITATION(S) 02040050299

0205 Products And By-products

REFER ALSO TO CITATION(S) 02050050088

0206 Health And Safety

REFER ALSO TO CITATION(S) 02060050637

49453 **(VERITAS-TN—20-002-82) Risk for collisions with oil and gas installations on the Norwegian continental shelf. Collection and preparation of data. Part report No. 3. Reported infringements of safety zones around Norwegian offshore installations.** Corneliussen, C; Laheld, P. (Norske Veritas, Oslo). Jan 1982. 39p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84751653.

The reported infringements of the 500 meter safety zones around offshore installation on the Norwegian continental shelf during the period Jan 1975 - Jan 1982 are presented. A comparison is made with the reported infringements on the U.K. continental shelf during the same period. 4 figures, 13 tables.

0207 Marketing And Economics

REFER ALSO TO CITATION(S) 02070049467, 49504

49454 **(DOE/EIA—0109(84/07)) Petroleum supply monthly, July 1984.** (USDOE Energy Information Administration, Washington, DC). Sep 1984. 107p. NTIS, PC A06/MF A01; 1 - GPO; GPO Dep. File Number DE85001166.

This report contains detailed statistics on the supply and disposition of petroleum and petroleum products for July 1984. Information on crude oil, finished motor gasoline, distillate fuel oil, residual fuel oil, liquefied petroleum gases are included. Detailed statistics show production for the current month as well as the year-

to-date. Data are also tabulated for the US Petroleum Administration for Defense (PAD) Districts which include field production, refinery production, imports, stock withdrawal or addition, unaccounted for crude, net receipts, crude losses, refinery inputs, exports, products supplied, and ending stocks. This issue also presents IEA's winter 1984-1985 distillate fuel outlook and an overview of distillate fuel oil. These articles focus on the respective roles of production, imports, and stocks in meeting distillage fuel oil demand. Regional supply patterns, especially for the East Coast are also discussed. 33 tables. (DMC)

49455 **(DOE/EIA—0380(84/07)) Petroleum marketing monthly, July 1984.** (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). Oct 1984. 134p. NTIS, PC A07/MF A01; 1 - GPO; GPO Dep. File Number DE85000472.

This report presents monthly summaries of petroleum product statistics for the US, Petroleum Administration for Defense (PAD) Districts, and individual states. Four types of petroleum product statistics are included: sale prices, sale volumes, percentages of product sales, and first sales of products for consumption. Salient statistics are highlighted in a summary section, and each of the four subjects are treated in detail in other sections. The first tables in each of the first three sections provide national-level statistics on sales of the various products to end-users and for resale. The following tables provide finer geographic and type of seller detail and are grouped by product, beginning with motor gasoline and ending with either residual fuel oil or propane. The majority of the tables show data for the report month and previous month for the current year. Data on motor gasoline, aviation fuel, jet engine fuel, kerosene, distillate fuel oils, residual fuel oils, and propane are included. 59 tables.

49456 **(DOE/EV/10472—T6) Analysis of changes introduced under the proposed OCS leasing schedule.** (Rogers, Golden and Halpern, Inc., Philadelphia, PA (USA)). Dec 1981. Contract AC01-81EV10472. 23p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000726.

This paper examines seven questions pertaining to the Proposed 5-Year Outer Continental Shelf (OCS) Oil and Gas Leasing Schedule. Litigation has proved to be inherent to the OCS leasing program and it is most likely that the number of lawsuits will increase if the proposed leasing schedule is approved. The preparation of area-wide Environmental Impact Statements can expedite the leasing process, provided that court actions do not lengthen their scheduled timeline. While the economic benefits of expanded OCS drilling may be great, the lack of good research upon which to base estimates of environmental cost precludes any reliable cost-benefit analysis. Use of planning areas should facilitate OCS oil and gas exploration, but it remains to be seen if less detailed environmental assessments will result in adequate protection of the marine and coastal environments. The proposed OCS leasing schedule should encourage technological development and most industries that support OCS exploration, development, and production activities indicate that their development of technology and inventory of supplies are increasing in anticipation of increased OCS activity. Bonus bidding systems (1) provide the federal government with immediate revenues, (2) provide a conclusive method for awarding leases, and (3) limit bidding to companies who can afford large front-end payments. Although untested, non-bonus bidding systems may (1) eventually generate greater revenues, available at the time of production, (2) increase competition, and (3) reduce the possibility of land banking. Current procedures for awarding leased tracts provide 10-year terms in OCS where exploration is difficult, which includes deep-water tracts.

49457 **(DOE/PE/70267—T4) Strategic oil stocks and public-private interactions: a dynamic game analysis.** Murphy, F.H.; Toman, M.A.; Goldstein, M.J. (Resources for the Future, Inc., Washington, DC (USA)). Sep 1984. Contract AC01-80PE70267. 91p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85001581.

Energy and National Security Series, Discussion Paper D-82X.

This paper presents an intertemporal numerical strategic oil stockpiling model that explicitly addresses interactions between public and private inventory decisions, rather than focusing on the public inventory decision alone. The model also can be used to examine public and private stockpiling under a wide range of assumptions about disruption risks or demand and supply conditions. Using simplified yet reasonable assumptions, numerical experiments with the model indicate that: (1) unless the disruption severity is high or the crisis is likely to persist, the optimal public stockpile size is significantly smaller than one billion barrels; (2) private inventory speculation is crowded out by public stockpiling in moderate crisis scenarios but not in severe crisis cases; (3) a rapid release policy for the public reserve is optimal unless the crisis is very large or likely to perist; and (4) the imposition of a dynamically optimal oil import tariff has a relatively modest effect on equilibrum stockpile strategies, except in cases of severe or persistent crisis. The modeling technology used in the study also is of interest in its own right. We discuss how this technology may provide a useful tool for analyzing a variety of stochastic dynamic game, particularly games involving an infinite horizon. 28 references, 13 figures, 10 tables.

49458 **(DOE/PE/70267—T6) Risk aversion and the insurance value of strategic oil stockpiling.** Toman, M.A.; Macauley, M.K. (Resources for the Future, Inc., Washington, DC (USA)). May 1984. Contract AC01-80PE70267. 31p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85001579.

Energy and National Security Series, Discussion Paper D-82W.

In this paper we estimate the value of strategic oil stockpiling in reducing the welfare cost of the US economy of income risks induced by fluctuating oil prices. The estimates, derived by combining quarterly data with a Taylor series approximation of the stockpile premium, range from $.30/bbl to $3.00/bbl depending on the assumptions made about risk preferences and other influences. However, the lower range of the estimates - under $1.00/bbl - probably is closer to the true value. Thus, the estimates suggest little need for adjusting benefit-cost analyses of optimal government stockpiling to reflect attitudes toward risk. 37 references, 1 table.

49459 **(DOE/PE/70267—T7) Oil supply disruptions and the role of the International Energy Agency.** Bohi, D.R.; Toman, M.A. (Resources for the Future, Inc., Washington, DC (USA)). May 1984. Contract AC01-80PE70267. 38p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85001580.

Energy and National Security Series, Paper D-82Y.

The mutual gains from international cooperation in responding to an oil supply disruption are substantial, and the IEA has an important part to play in reaping these gains. However, both the thrust of the current IEA Agreement and ambiguities concerning key provisions limit its capacity to attain successful cooperation. To better achieve this goal, the primary focus of the Agreement should be shifted from targeted embargoes and burden-sharing to coordinated, market-oriented responses involving import demand restraint and stockpiling. The paper also emphasizes the role of the IEA in promoting an environment conductive to cooperation through harmonizing members' interests and expectations. 16 references, 2 tables.

49460 **(DOE/PE/70267—T8) Geographic variation in fuel flexibility: implications for the regional incidence of oil supply disruptions.** Macauley, M.K. (Resources for the Future, Inc., Washington, DC (USA)). Apr 1984. Contract AC01-80PE70267. 60p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85001582.

This paper indicates that regional patterns of private investment in fuel-switching capability are explained by geographic differences in economic incentives and regulatory constraints on fuel use and fuel supplies. From a broader perspective of the effect of interfuel substitutability on the demand for oil, these disparities imply that the incidence of the costs of an oil import supply disruption will also vary regionally. Consequently, energy policy designed to ensure a welfare-optimal level of shockproofing may need to accommodate interregional differences. In this regard, federally funded regional petroleum reserves have been suggested to shockproof particular areas against disruptions. The advantage of regional storage is not obvious, however. The effect of reserves, irrespec-

tive of storage location, is to reduce price uncertainty which otherwise induces investment in fuel-flexible capital. Policymakers must evaluate the marginal costs and benefits of the location of reserves in terms of the effect of their delivered price on income redistribution, and the existence of reserves, irrespective of their storage locale, in terms of their effect on alternative shockproofing activities. Federal government intervention specifically to encourage fuel flexibility may also be economically inefficient or indiscriminately income redistributive or both unless geographic variation in resource endowments and the effects of existing regulatory constraints on energy markets are taken into account. In addition, identifying interregional differences in order to accommodate them in federal legislation for either investment tax credits or even detailed geographic strategic petroleum reserve allocations, say, is likely to be administratively costly. The implication is that policy to encourage nonoil fuel use or fuel flexibility may be better implemented at a more local rather than at the federal level. 44 references, 4 figures, 9 tables.

49461 **(ORNL/TM—9204) Model of the world oil market with an OPEC cartel.** Alsmiller, R.G. Jr.; Horwedel, J.E.; Marshalla, R.A.; Nesbitt, D.M.; Haas, S.M. (Oak Ridge National Lab., TN (USA)). Aug 1984. Contract AC05-84OR21400. 33p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85001498.

A world oil market model (WOM) with OPEC treated as a Stackelberg cartel has been developed within the framework of the Generalized Equilibrium Modeling System (GEMS) that is available from Decision Focus, Inc. The US sector of the model is represented by a Liquid Fuels Supply model that was presented previously. The WOM model is described and results obtained with the model for the period 1980 to 2040 are presented. For comparative purposes, results obtained with the model when OPEC is treated as a competitive producer are also presented. By comparing the world oil price as a function of time from the two calculations, the influence that OPEC may have on the oil market by exploiting all of its market power is quantified. The world oil price as obtained with the WOM model is also compared with world oil price projections from a variety of sources. 22 references, 9 figures, 2 tables.

0209 Environmental Aspects

REFER ALSO TO CITATION(S) 02090050634, 50640

49462 **(PB—84-202365) Report to the Shetland Oil Terminal Environmental Advisory Group on the 1982 and 1983 surveys of Eider moult flocks.** Heubeck, M. (Shetland Oil Terminal Environmental Advisory Group, Aberdeen (UK)). 1984. 34p. NTIS, PC E04/MF E04.

During summer and early autumn, Eiders in Shetland form large moult flocks that are generally located in traditional sites, usually offshore stacks and skerries or below the cliffs of certain headlands. While in these flocks, the birds moult all their flight feathers simultaneously and so, being flightless, are especially vulnerable to oil pollution. Initially, the flocks are largely composed of adult males but these are joined by females and young birds as the summer progresses. Thus by late August a large proportion of Shetland's Eider population is concentrated at certain known locations and are therefore easily surveyed. Such a survey has two main aims: To obtain an estimate of the Shetland Eider population and to detect changes in the status of Eiders in Shetland; To maintain information on the location of large concentrations of Eider for the purposes of oilspill contingency planning and response to oil pollution threats. (Copyright (c) The Shetland Oil Terminal Environmental Advisory Group 1984.)

49463 **(PB—84-202431) Report to SOTEAG (Shetland Oil Terminal Environmental Advisory Group) on numbers of Tysties ('Cepphus grylle') in the area of the Yell Sound Islands, September 1982.** Richardson, M.G.; Ewins, P.J. (Shetland Oil Terminal Environmental Advisory Group, Aberdeen (UK)). 1983. 14p. NTIS, PC E03/MF E03.

See also PB83-257923.

Three previous surveys (1979 - 1981) have been conducted around the Yell Sound Islands for Tysties. These surveys have been tied to the third week of August when most young birds will have fledged and are identifiable on the water as juveniles. These autumn counts of Tysties are directed principally at gauging the recovery of this species following the 'Esso Bernicia' oil spill both in terms of the overall numbers of birds present in the area and their breeding success. (Copyright (c) The Shetland Oil Terminal Environmental Advisory Group 1983.)

49464 **(PB—84-203223) Report to the Shetland Oil Terminal Environmental Advisory Group on the Shetland Beached Bird Survey, March 1982-February 1983.** Heubeck, M. (Shetland Oil Terminal Environmental Advisory Group, Aberdeen (UK)). 1983. 21p. NTIS, PC E03/MF E03.

See also PB84-203231.

This report presents the results of the Shetland Beached Bird Survey for the 12-month period March 1982 to February 1983. The presentation is, on the whole, limited to data obtained during this period only although reference is made to data gathered during previous years where specific points are being made. (Copyright (c) The Shetland Oil Terminal Environmental Advisory Group 1983.)

49465 **(PB—84-203231) Report to the Shetland Oil Terminal Environmental Advisory Group on the Beached Bird Survey in Shetland, March 1980-February 1982, with a review of results since July 1978.** Heubeck, M. (Shetland Oil Terminal Environmental Advisory Group, Aberdeen (UK)). 1982. 37p. NTIS, PC E04/MF E04.

See also PB84-203223.

Monthly Beached Bird Surveys were started in Shetland in July 1978 and have continued since apart from a 3-month gap between December 1978 and February 1979. This report presents the results of surveys carried out between March 1980 and February 1982 inclusive but also incorporates past data into some figures and analyses. (Copyright (c) The Shetland Oil Terminal Environmental Advisory Group 1982.)

49466 **(PB—84-205368) Air quality monitoring at Sullom Voe using lichens as biological indicator species: results of the 1981 and 1982 repeat photographic surveys.** James, P.W.; Syratt, W.J. (Shetland Oil Terminal Environmental Advisory Group, Aberdeen (UK)). 1983. 28p. NTIS, PC E04/MF E04.

The lichen monitoring program has been running for 5 years. In 1976 the program was set up to answer a number of questions. Since the first survey nothing has changed to alter the view that 'there will be little in the way of harmful emissions from the Terminal'. The absence of any deterioration in the lichen flora, a sensitive biological indicator of air quality, supports this. The authors are confident in asserting that beyond a very small radius (if any), too small to be detected in the current lichen monitoring program, there has been no deterioration in air quality as a result of the construction and operation of the Sullom Voe Oil Terminal. In conclusion it has been demonstrated that the use of close up color photography of permanent lichen quadrats is a sensitive method of detecting change in the lichen flora.

0210 Legislation And Regulation

REFER ALSO TO CITATION(S) 02100049459, 49460

49467 **(DOE/EV/10472—T2) Identification of changes introduced under the proposed OCS leasing schedule.** (Rogers, Golden and Halpern, Inc., Philadelphia, PA (USA)). Nov 1981. Contract AC01-81EV10472. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85000728.

This report presents a review of the proposed changes for streamlining and accelerating the Department of the Interior's (DOI) Outer Continental Shelf (OCS) oil and gas leasing program. DOE proposals include changing the size of the areas to be leased, streamlining the Environmental Impact Statement (EIA) and prelease processes, increasing the number of lease sales, improving coordination under the National Pollutant Discharge Elimination System (NPDES), and possibly changing agency administrative responsibilities to accompany the adoption of the proposed program. A proposed 5-year program for the period from January 1982 through December 1986 was submitted by DOE to Congress, the

Attorney General, and Governors of affected States in July 1981 for their review and approval. Periodic review of the 5-year OCS leasing program is done per section 18(c)(2) of the OCS Lands Act (OCSLA), as amended. Adoption of the proposed program would accelerate the pace of leasing by adding more sales. The proposed program also introduces procedures to streamline or shorten the time involved in pre-sale steps and to eliminate unnecessary regulations during the post-lease phase. The proposed program is intended to help reduce US dependence on foreign oil and to aid domestic economic recovery. DOI feels that streamlining and accelerating the process will facilitate exploration and development by making high quality prospective hydrocarbon-bearing acreage available earlier and more frequently than under the current program. The proposed program would allow a faster inventory of domestic oil and gas resources, especially in frontier areas where such inventories are incomplete, and it would lead to early production if commercial discoveries were made. 5 figures, 1 table.

49468 **(DOE/EV/10472—T3) Consistency: current issues.** (Rogers, Golden and Halpern, Inc., Reston, VA (USA)). Sep 1982. Contract AC01-81EV10472. 22p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000724.

Offshore oil and gas is one of several energy sources that could contribute to domestic energy production. Offshore oil and gas development has numerous constraints to overcome. One of these is to deal with the increasing and competing demands for coastal resources. The Coastal Zone Management Act states that the management of coastal resources is a federal and state responsibility. With the increasing demand on the resources of the coastal zone, the partnership between federal and state governments has become increasingly important, and also more strained. Often, it is the federal government that provides technical assistance, reflects national interests, provides funding, and promotes public awareness on a national basis. The states represent local interests and provide input, both environmental and economic, that is unique to a particular geographical area. This adjustment for local interests and conditions needs to be made, but federal policy provides consistent standards between states, thus, a clear national directive is needed. As a condition for federal approval of their respective coastal zone management plans, states are required to give consideration to national energy interests in managing coastal resources. The major part of the controversy over consistency is centered around offshore oil and gas activity and the application of consistency determinations to federal activities prior to exploration. States have been given granted authority to review, modify, and potentially prohibit certain federal activities, although the federal government resumes the right to evoke an overriding national interest. This paper addresses issues surrounding consistency determinations under the Coastal Zone Management Act. This paper provides only a short survey of the historical record. Discussion focuses on the basic issues and regulatory, judicial, and congressional activities related to consistency. 27 references.

49469 **(DOE/EV/10472—T5) Summary of United States-Canada and United States-Mexico maritime boundary disputes in relationship to hydrocarbon resources.** (Rogers, Golden and Halpern, Inc., Philadelphia, PA (USA)). Sep 1982. Contract AC01-81EV10472. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000723.

The United States shares boundaries with both Mexico and Canada. Although the United States' relations with both countries are generally amicable, the maritime boundaries between the United States and both her neighbors are unresolved. The resolution of these maritime boundary disputes may affect the amount of hydrocarbon resources belonging to each country if the disputed boundary areas overlie oil or gas reservoirs. However, it seems unlikely that the hydrocarbon reserves of any of the three countries will be significantly impacted by the resolution of the various boundary disputes. 18 references.

49470 **Energy emergency preparedness. Hearings before the Subcommittee on Fossil and Synthetic Fuels of the Committee on Energy and Commerce, House of Representatives, Ninety-Eighth Congress, Second Session, February 1, 2, and 21, 1984.** Washington, DC, USA; Government Printing Office (1984). 48p.

Energy Secretary Hodel, representatives of the petroleum industry and institutional research groups, and other witnesses speaking for farmers and consumers testified during three days of hearings on the draft version of the Domestic Energy Emergency Preparedness Act of 1984. At issue was the administration's intent in lowering the rate of filling the strategic petroleum reserve (SPR), the fragmentation of responsibility for the SPR due to reorganization within DOE, the lack of administrative procedures for meeting energy-sharing obligations to members of the International Energy Agency, and the lack of detailed planning for an energy supply disruption. Hodel justified the draft version on the grounds of an improved energy situation. Additional material submitted for the record follows the testimony of 10 witnesses.

0220 Transport, Pipelines, And Handling

REFER ALSO TO CITATION(S) 02200049961

49471 **Judging defect severity on offshore pipelines.** Kiefner, J.F.; Maxey, W.A. (Battelle Columbus Laboratories, OH). *Oil and Gas Journal;* **80**: 68-74(24 May 1982).

In spite of the great care taken in manufacturing, installing, and protecting offshore pipelines, defects often occur and a few have caused pipeline failures. Criteria and methods for assessing the severity of pipeline defects are well known, but their application to offshore lines calls for extra considerations. Defects can arise during pipe fabrication or pipelaying; they can also result from mechanical damage, internal and external corrosion, and mud slides. An offshore operator will rarely need to apply a criterion for determining whether to repair or remove a defect; however, when such a criterion would be useful, it should be modified to take advantage of the external pressure provided by the seawater.

0230 Properties

49472 **(NIPER—132-PPS-83/5) Diesel fuel oils, 1983.** Shelton, E.M. (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). Nov 1983. Contract FC01-83FE60149. 25p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001685.

Properties of diesel fuels produced during 1983 were submitted for study and compilation under a cooperative agreement between the National Institute for Petroleum and Energy Research (NIPER), Bartlesville, Oklahoma and the American Petroleum Institute (API). Tests of 192 samples of diesel fuel oils from 87 refineries throughout the country were made by 31 petroleum groups according to type of diesel fuel. Each group of analyses is subdivided into five tabulations according to five general regions of the country where the fuels are marketed. The regions, containing a total of 16 districts, are shown on a map in the report. Data from 13 laboratory tests on each individual diesel fuel sample are listed and arranged by geographic marketing districts in decreasing order of sales volumes. Charts are included showing trends of averages of certain properties for the two grades of diesel fuels. Summaries of the results of the 1983 survey, compared with similar data for 1982, are shown in Tables 1 and 2 of the report. 3 figures, 4 tables.

0240 Storage

49473 **(DOE/NBM—5001191) Statement of Deputy Assistant Secretary for the Strategic Petroleum Reserve before the Subcommittee on Oversight and Investigations of the Committee on Energy and Commerce, US House of Representatives.** Furiga, R.D. (USDOE Assistant Secretary for Environmental Protection, Safety and Emergency Preparedness, Washington, DC. Office of the Deputy Assistant Secretary for Strategic Petroleum Reserve). 24 Sep 1984. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001191.

The status of the Strategic Petroleum Reserve (SPR) is reviewed for the subcommittee. There are over 430 million barrels of crude oil in the reserve. The fill rate goal of 186,000 b/d for 1984 has been fulfilled. Development of Phase II is continuing on sched-

ule. SPR distribution capabilities are discussed in detail as well as SPR management and contracting operations. (DMC)

0250 Combustion

REFER ALSO TO CITATION(S) 02500050433

03 NATURAL GAS

REFER ALSO TO CITATION(S) 03000049443

0301 Reserves

REFER ALSO TO CITATION(S) 03010049444, 49474

0302 Geology And Exploration

REFER ALSO TO CITATION(S) 03020050660

49474 **(DOE/METC/SP—207) Eastern gas shales subprogram.** (Department of Energy, Morgantown, WV (USA). Morgantown Energy Technology Center). Feb 1984. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84011991.

The goal of the Eastern Gas Shales Subprogram (EGSS) is to develop scientific and engineering knowledge and to enable the recovery of natural gas from shale formations that underlie the Appalachian, Illinois, and Michigan Basins. To pursue this goal, the geology and chemistry of gas-bearing Devonian shales was characterized early during the subprogram. As information was gathered and knowledge of the shales increased, studies of well completion and stimulation methods were conducted in the laboratory as well as in the field. Recently, the synthesis of geologic and geochemical data marked the conclusion of the resource characterization effort. Upon the completion of the resource characterization, project emphasis was directed toward understanding the fractured shale reservoir and its gas storage and production characteristics. The Meigs County, Ohio, offset well test established the directional aspects of shale gas production, providing new insight into field development. In addition, a methodology for characterizing gas flow behavior allows for the development and application of novel extraction methods to increase the otherwise poor recovery efficiency of current extraction methods.

49475 **(NP—5900053) Stratigraphically controlled gas production from Abo red beds (Permian), east-central New Mexico.** Broadhead, R.F. (New Mexico Bureau of Mines and Mineral Resources, Socorro (USA)). 1984. 38p. New Mexico Bureau of Mines and Mineral Resources, Socarro, NM 87801. File Number TI85900053.

Includes 4 sheets of 24x reduction microfiche; Circular 183.

Red-bed sandstones of the Abo Formation currently produce natural gas from the Pecos Slope Abo field in northern Chaves County, New Mexico. The Pecos Slope Abo field is located on the Northwest shelf of the Permian Basin. Production currently comes from an approximately 700 mi^2 area. The Abo has been designated a tight gas sand, thus Abo gas can be sold for as much as $5.41 per MCF, $2.60 more than the regulated ceiling price of gas produced from formations not designated as tight. The tight-sand designation greatly stimulated drilling, and more than 350 wells have been drilled since field discovery in 1977. Because of low permeability, wells must be artificially fractured to obtain economic production. Initial calculated open flow rises from a few tens of MCFGPD before fracturing to an average of approximately 2200 MCFGPD after fracturing. The Abo red beds are subdivided vertically into three informal lithologic units on the Northwest shelf of the Permian Basin: a lower unit of granite wash, a middle unit of mudstone, and an upper unit of interbedded sandstone and mudstone. Gas is produced from sandstones of the upper unit. Primary porosity has been reduced by compaction to values near zero. The average in situ matrix permeability of Abo sandstones is only 0.0067 millidarcies. Such small amounts of matrix porosity and permeability probably do not contribute greatly to production. The Abo wells tap a gas-filled natural fracture system, and mudstones seal the fractured sandstone reservoirs. Because fluvial-deltaic deposits extend almost 100 mi (160 km) north of present production, the area underlain by potential Abo sandstone reservoirs is at least five times greater than the area that is currently productive. 79 references.

49476 **Model for fracture genesis: application to Mesaverde group, Piceance Creek basin, Colorado.** Teufel, L.W.; Warpinski, N.R.; Lorenz, J.C. (Sandia National Laboratories, Alburquerque, NM). *American Association of Petroleum Geologists, Bulletin;* **68**: No. 4, 534(Apr 1984). (CONF-8405216—).

From AAPG annual convention; San Antonio, TX, USA (20 May 1984).

Natural fractures play an important role in determining gas production from the low-permeability reservoirs of the Mesaverde Group in the Piceance Creek basin, Colorado. The importance of natural fractures is evident from the number of natural fractures observed in core and from the high in-situ permeabilities measured in well tests as compared to the low permeabilities measured in core. An understanding of the natural fracture systems requires knowledge of variations in the state of stress and changes in the physical and mechanical properties of the different sedimentary layers during the evolution of the basin. Geologic processes such as burial, diagenesis, tectonics, uplift, and erosion, and their resultant effects on the overburden, pore pressure, temperature, and strain were included in an elastic-plastic model to approximate the stress history of the basin. These data, coupled with an extended von Mises failure criterion derived from laboratory experiments of the rocks in question, were used to predict the relative time and type of fracturing, and the lithologic layers in which a fracture was likely to occur. Observations of fractures in 4200 ft (1280 m) of core (1200 ft, 365 m, of oriented core) from the Mesaverde Group taken from the US Department of Energy's 3 closely spaced wells near Rifle, Colorado, have been used to document the genesis of natural fractures and substantiate the model results. Empirical information such as the present state of in-situ stress determined from hydraulic fracture stress tests and anelastic strain recovery measurements of oriented core, paleostrain directions and magnitudes determined from analysis of calcite twin lamallae, and current temperature and pore pressure provided data as well as checks on the accuracy of the model.

0303 Drilling, Production, And Processing

REFER ALSO TO CITATION(S) 03030049449, 50436

49477 **(LBL—16518) Downhole sampling of geopressured gas wells. Final report, June 1982-July 1984.** Weres, O; Michel, M.; Harnden, W.; Newton, A. (Lawrence Berkeley Lab., CA (USA)). Jul 1984. Contract AC03-76SF00098. 61p. (GRI—83/0028). NTIS, PC A04/MF A01; GPO Dep. File Number DE85001418.

Under a previous GRI supported project, LBL designed and built a downhole fluid sampler for use in geopressured gas wells. This report describes engineering tests performed on the sampler, and the design and fabrication of auxiliary tools needed to use the sampler effectively. The fluid inside the sampler exchanges with ambient fluid in a few minutes; therefore, fluid exchange rate is no problem. The sample extraction system allows brine to air. Wellhead samples of gas condensate, oil, and brine from geopressured gas wells were analyzed. The condensates are derived from oil dispersed in the reservoir rock. The unusual aromatic condensates represent the relatively water soluble fraction of the oil. The paraffinic condensates represent production of oil by solution in dense, high pressure gas downhole. Geopressured brines contain carboxylic acid anions, which cause them to have B.O.D. These anions may be chemical precursors to the gas dissolved in the brine. 13 references, 15 figures, 2 tables.

0305 Health And Safety

REFER ALSO TO CITATION(S) 03050049453

0306 Marketing And Economics

REFER ALSO TO CITATION(S) 03060049456, 49467

49478 (DOE/EIA—0130(84/07)) Natural gas monthly, July 1984. (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). Sep 1984. 136p. NTIS, PC A07/MF A01; 1 - GPO; GPO Dep. File Number DE85000303.

This report presents recent data and current estimates on the consumption, disposition, prices, storage, import and export of natural gas in the USA for July 1984. Also included are operating and financial data for major interstate natural gas pipeline companies plus data on filings, ceiling prices and transportation under the Natural Gas Policy Act of 1978. A feature article on contracts between interstate pipelines and their customers is included. Information on underground storage of natural gas and storage operators is tabulated. Consumption of natural gas during July 1984 was 1162 billion cubic feet (Bcf), 9.0 percent above the July 1983 level. Consumption is broken down into consuming sectors. The average wellhead price in May 1984 was $2.62 per thousand cubic feet (Mcf). In July 1984 was $6.15 Mcf, slightly below the July 1983 price. 24 tables (DMC)

49479 (DOE/PE/70267—T5) Transport costs and the spatial distribution of natural gas prices. Montgomery, W.D.; Gottlieb, M. (Resources for the Future, Inc., Washington, DC (USA)). Oct 1983. Contract AC01-80PE70267. 44p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85001583.

Costs of transporting and distributing gas vary across regions and customer classes. The purpose of this paper is to analyze how these costs affect the distribution of gas prices in market equilibrium, the relation between gas prices and prices of competing fuels, and the price of gas in the field. It is assumed throughout the paper that (1) uniform field prices prevail and (2) in some markets the price of gas to industrial consumers is determined by competition with residual fuel oil. In order to link delivered industrial prices with field prices, it is also necessary to make some assumption about how other customer classes are treated. If it is assumed that there is no cross-subsidization among customer classes, the following conclusions are reached: field prices would equal the Btu equivalent of the price of fuel oil less transportation costs to the market in which gas and oil compete on the margin; in more distant markets with higher transportation costs gas would be more expensive than residual fuel oil, and industrial customers able to switch easily from gas to oil would do so; in markets closer to the field, with lower transportation costs gas would be less expensive than residual fuel oil, and residual fuel oil would not be used by any consumers capable of burning gas; sales-weighted average prices charged industrial customers would be less than the Btu equivalent of residual fuel oil. 2 references, 9 figures, 7 tables.

49480 (GAO/RCED—84-178) Natural gas price increases in Los Angeles. (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 31 Jul 1984. 59p. US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760. File Number TI85900098.

Natural gas price increases in recent years captured congressional and public attention. To determine which factors contributed to an average price increase of 61% in the Los Angeles, California, area between April 1981 and April 1983, GAO obtained and analyzed information from the distribution company which sells gas to retail customers in Los Angeles, the state agency which regulates it, and the distribution company's four principal pipeline company suppliers. GAO found that about three quarters of the price increase was due to: (1) the depletion of old and less expensive gas reserves and the addition of new and higher cost reserves; (2) price increases permitted by federal regulation; (3) increased imports of relatively expensive Canadian natural gas; (4) contract clauses affecting purchases by the distribution company and its pipeline suppliers; and (5) a decline in gas consumption which made purchasing patterns and company operations less efficient. The remaining increases stemmed from operating costs. 1 figure, 14 tables.

0308 Environmental Effects

49481 (PB—84-224336) Subsidence monitoring in conjunction with methane gas production in Louisiana (phase 1, deep well program). Annual report November 1981-January 1983. Statton, C.T. (Woodward-Clyde Consultants, Wayne, NJ (USA)). Aug 1983. 183p. NTIS, PC A09/MF A01.

Ground deformation monitoring arrays installed at deep methane gas wells (Sweet Lake and Gladys McCall wells) in southwestern Louisiana were continued and data were compiled. High quality data were obtained from the instrumentation arrays. These data include elevation changes of the ground surface determined by first-order levelling arrays, tilt of the ground surface measured by tilt meters of high sensitivity, and the location of low-intensity microseismic events detected by a microseismic monitoring network. The relationship among these observations is not clear at present. A temporal coincidence between observed tilt excursions, microseismicity and large pressure reductions in the production and disposal wells is apparent. Heavy rainfall over a brief period also appears to be coincident with some tilt and microseismic events. These relationships will be further investigated in upcoming phases of this ongoing study.

0309 Artificial Stimulation

REFER ALSO TO CITATION(S) 03090049474, 49475

49482 (UCRL—15563) Feasibility study: vertical fracturing in directionally drilled wells. Final report, January 1983-September 1983. Towse, D. (Lawrence Livermore National Lab., CA (USA)). Oct 1983. Contract W-7405-ENG-48. 157p. (GRI—83/0047). NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE85000999.

This report evaluates the applicability of directional drilling technology and hydraulic fracturing for the extraction of gas in tight sands, eastern US Devonian shale, and coalbeds. Productivity and economic studies were based on computer reservoir simulations over a range of reservoir parameters and well configurations. Drilling technology and equipment costs were developed from literature and industry surveys, together with numerical studies of drilling mechanics and the fracturing process. The drilling concerns are (1) the lack of satisfactory means to measure the location of the drillbut relative to the boundaries of the pay zone, (2) the possibility of the well casing buckling, and (3) the ability to displace drilling mud from the horizontal portion of the well to ensure an adequate cement job. This study may form the basis for further investigations in tight sand reservoirs. It is unlikely that there is sufficient economic incentive to address the resources in Devonian shales and coalbeds with this drilling and fracturing aproach because of technical uncertainties in both drilling and reservoir properties. 40 references, 37 figures, 46 tables.

49483 Apparatus for recovering gaseous hydrocarbons from hydrocarbon-containing solid hydrates. Elliott, G.R.B.; Barraclough, B.L.; Vanderborgh, N.E. (to Dept. of Energy). US Patent 4,424,858. 10 Jan 1984. Filed date 27 Sep 1982. vp.

PAT-APPL-424691.

A method and apparatus are provided for producing gaseous hydrocarbons from formations comprising solid hydrocarbon hydrates located under either a body of land or a body of water. The vast natural resources of such hydrocarbon hydrates can thus now be economically mined. Relatively warm brine or water is brought down from an elevation above that of the hydrates through a portion of the apparatus and passes in contact with the hydrates, thus melting them. The liquid then continues up another portion of the apparatus, carrying entrained hydrocarbon vapors in the form of bubbles, which can easily be separated from the liquid. After a

short startup procedure, the process and apparatus are substantially self-powered.

0310 Legislation And Regulation

REFER ALSO TO CITATION(S) 03100049467, 49468, 49469

49484 **Proposed changes to natural gas laws (Part 5). Hearings before the Subcommittee on Fossil and Synthetic Fuels of the Committee on Energy and Commerce, House of Representatives, Ninety-Eighth Congress, First Session.** Washington, DC, USA; Government Printing Office (1984). 693p.

Field hearings in Chicago and in Tyler, Texas and a third hearing in Washington considered natural gas production and pricing issues. Witnesses were asked to discuss the impact, particularly for the elderly, on consumer prices associated with Outer Continental Shelf (OCS) gas, the role of state regulators in setting production levels, and the practice of prorationing by interstate pipelines. The witnesses included local realtors and businesses, gas utilities, regulators, consumer groups, and representatives of the gas production and distribution industries. The field hearings focused on consumer problems in Chicago and on producer problems in Tyler. Material submitted for the record follows the testimony of 44 witnesses.

0320 Transport, Pipelines, And Handling

REFER ALSO TO CITATION(S) 03200049471, 49961

49485 **(CONF-8405234—3) Alaska Natural Gas Transportation System.** Jones, V.T. (Northwest Energy Co., Salt Lake City, UT (USA); Williams Companies, Tulsa, OK (USA)). 27 Apr 1984. 11p. Greater Seattle Chamber of Commerce, 1200 One Union Square, 6th and University, Seattle, WA 98101. File Number TI84901838.

From 3. Alaska Resources conference; Seattle, WA, USA (6 May 1984).

The proven reserves of natural gas in Prudhoe Bay remain the single largest block of reserves under US control. The sponsors of the Alaska Natural Gas Transportation System, including The Williams Companies, remain convinced that Alaskan gas will be increasingly important to meet future needs here in the lower 48 states. Both Canada and the US will increasingly have to turn to more costly supplies of gas as the closer, traditional areas of gas supply are exhausted. A principal motivation for Canada's participation in the ANGTS was the prospect of a jointly sponsored pipeline through Canada which would facilitate bringing frontier gas to market - through the so-called Dempster lateral. The high cost of transportation systems in the Artic necessitates pipelines with large capacities in order to minimize the cost of transportation per unit of gas delivered. It is clear that Canada still strongly supports the ANGTS project as a means of opening up the frontier resources of both Alaska and Canada.

49486 **Defect detection by acoustic emission. Part 2.** Kiefner, J.F.; Stulen, F.B. (Battelle Columbus Labs., OH). *Pipe Line Industry;* **57**: 35-41(Sep 1982).

Experiments evaluating a company's ability to detect an impending pipeline failure demonstrated that the acoustic emissions method allows the detection of flaws in time to prevent them from failing. The results also indicated that different defects may have different emission characteristics with respect to behavior with increasing pressure. Spurious noise arose from numerous sources such as pipe movement in newly backfilled portions, movement of a packing pig, and dust or rain falling on unburied portions of the line.

49487 **Defect detection by acoustic emission. Part 1.** Kiefner, J.F.; Stulen, F.B. (Battelle Columbus Labs., OH). *Pipe Line Industry;* **57**: 53-63(Aug 1982).

Battelle's evaluation of acoustic emissions produced by pipe defects consisted of monitoring seeded defects in an actual pipeline. Some of the defects were sufficiently severe to cause failures in the operating pressure range; others consisted of stress-corrosion cracks and mechanical damage. The primary objective of the experiment was to determine whether AE monitoring was capable of locating these various types of defects at suitable transducer spacing (a minimum of 500 ft).

0330 Properties

REFER ALSO TO CITATION(S) 03300049477

49488 **(DOE/MC/20013—T7) Laboratory analysis of gas hydrate cores for evaluation of reservoir conditions. Final report.** Holder, G.D. (Holder (Gerald), Morgantown, WV (USA)). Jun 1984. Contract AC21-83MC20013. 91p. NTIS MF A01; 2; GPO Dep. File Number DE85001449.

Methodology and procedures for the study of hydrate cores are detailed. Topics discussed are the (1) equipment and procedures for the formation and evaluation of hydrate cores in the laboratory, (2) the thermodynamic properties of gas hydrates, (3) the enthalpy of hydrate dissociation, (4) conditions in the earth where hydrates can form, (5) kinetics of hydrate formation and dissociation, and (6) heat transfer to gas hydrates. Empirical correlations for these properties and kinetic behavior are given. 24 references, 39 figures, 10 tables.

49489 **(DOE/MC/20693—T10) In-situ hydrate thermal measurements. Project status.** (Colorado School of Mines, Golden (USA). Dept. of Chemical and Petroleum Refining Engineering). 9 Oct 1984. Contract AC21-83MC20693. 21p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001014.

Work on the project is proceeding on schedule. Over the last month we have concentrated on: (1) developing a solution to the mathematical moving boundary problem, and (2) concluding experiments to determine the quality of the in-situ hydrate samples in our laboratory. In-situ gas hydrate samples recovered from the Deep Sea Drilling Project were experimentally tested to determine the ratio of hydrates to ice in the sample. The method of bomb calorimetry was used to test the samples. A gas chromatographic analysis was conducted on all gas samples. Sediment was retained to determine its mass percent in the sample. The gas hydrate samples were found to contain a maximum of twenty percent hydrate. Gas analysis revealed the presence of carbon dioxide and methane, with methane as the primary component. Other hydrocarbons were present in amounts less than one percent. These were normal-butane, iso-butane, ethane, and propane. Sediment accounted for approximately .91 to 6.61 percent of the total sample masses. One sample cylinder, however, contained nearly sixty percent sediment. 1 reference, 5 tables.

0340 Combustion

REFER ALSO TO CITATION(S) 03400050088, 50433

49490 **(PB—84-210616) Season interim performance report on the field operation of a residential space heating system, 1982/1983 (project report No. 6B).** (Ontario Ministry of Municipal Affairs and Housing, Toronto (Canada)). Nov 1983. 19p. NTIS, PC E03/MF E01.

Sponsored in part by Ontario Ministry of Energy, Toronto.

Recently, a number of ultra high-efficiency, residential sized, natural gas fueled condensing furnaces have been introduced into the marketplace by a variety of manufacturers. The Consumers' Gas Company Ltd. and the Ontario Ministry of Municipal Affairs and Housing (MAH) share a mutual interest in these new energy efficient furnaces and decided jointly to field evaluate a model of a new market entry condensing furnace on a fifty-fifty funding basis. This interim report covers the analysis of the data, collected over the 1982/1983 heating season.

04 OIL SHALES AND TAR SANDS

0401 Reserves And Exploration

49491 The Ohio oil shale core study, Shawnee No.1, Scioto County, Ohio. McClish, R.F.; Johnson, G.O.; Shafer, W.E. (Ohio Division of Energy, Columbus, OH). pp 163-167 of Proceedings 1983 Eastern Oil Shale Symposium. Lexington, KY, USA; Univ. of Kentucky, IMMR (1983). (CONF-831123—).

From Eastern oil shale symposium; Lexington, KY, USA (13 Nov 1983).

While Ohio is underlain by 25,000 square miles of Devonian/Mississippian organic rich shales, only the southern unglaciated portion of the main north-south outcrop represents a readily mineable resource. This five county area has been studied by previous DOE projects which have focused on surface field and archive data. The current study represents a transition to a more detailed effort of documentation based on subsurfaced coring, sampling and testing. The subject core hole is located at Shawnee State forest headquarters seven miles west of Portsmouth, Ohio on the Ohio river in Scioto County. The entire unsplit core was shipped to the USDOE Laramie Energy Technology Center, where it was split and tested. The second half was then returned to ODOE for further retort testing. The hole was drilled to a total depth of 696 feet of which 486 feet or 70 percent was cored with 98.4 percent recovery. The first core is interpreted to contain 0.4 feet of Henley Shale, 18.3 feet of Sunbury Shale, 1.3 feet of Berea Sandstone. The remaining Berea-Bedford section was drilled to within 21 feet of the Ohio Shale top. The final coring phase recovered these 21 feet of Bedford Shale and 439.5 feet of Ohio and Olentangy Shale, and recovered the top of the underlying Silurian carbonates. The well was logged with both the standard dry-hole and wet-hole geophysical suites. These results were computer cross-plotted and interpreted by Birdwell logging division. Other test runs included were down-hole TV scan, water quality and gas detection. The final data and interpretation of this core is intended to represent a standard oil shale control point for calibration of past and future studies in both Southern Ohio and Northern Kentucky, as well as from the surface to subsurface of the Ohio section.

0402 Site Geology And Hydrology

49492 The geology and geochemistry of Devonian Shales in South and West Central Kentucky. Robl, T.L.; Barron, L.S.; Bland, A.E.; Koppenaal, D.W. (Inst. for Mining and Minerals Res., Univ. of Kentucky, Lexington, KY). pp 59-71 of Proceedings 1983 Eastern Oil Shale Symposium. Lexington, KY, USA; Univ. of Kentucky, IMMR (1983). (CONF-831123—).

From Eastern oil shale symposium; Lexington, KY, USA (13 Nov 1983).

Devonian and Mississippian black shales crop out in a semicircular pattern around the Bluegrass physiographic provence of central Kentucky. The shales of this outcrop belt can be divided into a eastern limb or Appalachian stratigraphic sequence and a western limb or Illinios basin stratigraphic sequence. These are seperated by the Cincinnati arch, a midcontinental structural high. The Appalachian black shale sequence consists of the Mississiipian Sunbury Shale (black shale) underlain by the Bedford Shale (green shale) and the Ohio Shale (black shale). The Ohio is divided into the Cleveland Member, Three Lick Bed, and the Huron Member. Regionally all of the units thin from north to south. The Illinois basin black shale sequence consists of the New Albany Shale which is divided into the Clegg Creek Member, the Camp Run Member, the Morgan Trail Member and the Blocher Member. The New Albany also decreases in overall thickness from north to south. Features which can be traced across the Cincinnati arch between basins include, the Three Lick Bed, and the lithologies of the Camp Run and Blocher Members. Intervals high in organic carbon concentration are found in the upper and lower stratigraphic intervals of the shale in both basins. These intervals are found to be consistent in thickness, with most of the regional thinning of the units taking place in the intermediate units of lower organic carbon concentration. Nitrogen and hydrogen are found to be strongly correlated with organic carbon. From a mining perspective, the uppermost high carbon intervals of the shale are recoverable by surface mining throughout central Kentucky. The lower high carbon intervals would only be recoverable where the intermediate lower grade shales are sufficiently thin to mine through them, principally in west and south central Kentucky. Considerable thicknesses (i.e. >35 feet) of high carbon oil shale exist throughout the entire central Kentucky outcrop belt.

49493 A tectonic-climatic approach to the deposition of the Devonian-Mississippian black-shale sequence of North America. Ettensohn, F.E.; Barron, L.S. (Dept. of Geology, Univ. of Kentucky, Lexington, KY). pp 5-37 of Proceedings 1982 Eastern Oil Shale Symposium. Lexington, KY, USA; Univ. of Kentucky (1982). (CONF-8210274—).

From Symposium on eastern oil shale; Lexington, KY, USA (11 Oct 1982).

The Devonian-Mississippian black-shale sequence of North America is a distinctive stratigraphic interval that reflects a low rate of clastic-sediment influx, high organic productivity, and development of anaerobic conditions in a stratified water column within an inland, equatorial sea. The origin of these conditions apparently is related to the interaction of tectonism and climatic conditions unique to North America at that time. This widespread deposition of black shale was coincident with and related to the Acadian orogeny. The Acadian mountains developed across the equator east of the "Black-Shale Sea"; they completed enclosure of the sea and became the major source of clastic sediments. During episodic uplift, the mountains formed a partial orographic barrier to moisture-laden trade winds converging on the equator forming a rain-shadow west of the mountains and reducing clastic influx into the "Black-Shale Sea." With reduced clastic influx, organic-rich muds were deposited throughout the sea.

49494 • Geochemistry of Mississippian and Devonian oil shales of northeastern Kentucky. Bland, A.E.; Robl, T.L.; Koppenaal, D.W. *American Association of Petroleum Geologists, Bulletin;* **65**: No. 5, vp(May 1981). (CONF-8105250—).

From Annual AAPG-SEPM-EMD-DPA convention; San Francisco, CA, USA (31 May 1981).

Detailed chemical analysis were conducted on 10 cores drilled in Lewis and Fleming Counties of Kentucky in an oil-shale resource assessment funded by the US Department of Energy. The stratigraphic units studied include the Sunbury shale and the Ohio shale, which is divided (from top to bottom) into the Cleveland member, the Three Lick bed, and the Huron member. The chemical analysis include C, H, N, S, major element oxide, and trace-element determinations from 760 samples. Carbon concentration was found to increase from top to bottom in the Sunbury shale and Huron member, and decrease in the Cleveland member of the Ohio shale. Average carbon concentrations were 11%, 6%, and 9% by wt in these intervals, respectively. Oil yield was determined by Fischer-assay and a good correlation with carbon was found. The Cleveland produced approximately 10% more oil per unit of carbon than the Sunbury. The Sunbury shale was the least siliceous of the stratigraphic intervals and had the highest concentration of trace elements.

0403 Drilling, Fracturing, And Mining

REFER ALSO TO CITATION(S) 04030049492, 49505

49495 Fracture control blasting techniques for oil shale mining. Young, C.; Fourney, W.L. (Sunburst Recovery Inc., Steamboat, CO). pp 363-369 of Proceedings 1983 Eastern Oil Shale Symposium. Lexington, KY, USA; Univ. of Kentucky, IMMR (1983). (CONF-831123—).

From Eastern oil shale symposium; Lexington, KY, USA (13 Nov 1983).

The development of economically successful oil shale recovery techniques requires that both the mining and retorting operations be conducted as efficiently as possible. For mining operations this requires that the maximum possible extraction ratios and resource recovery ratios be realized. In underground mining operations, such as are envisioned for several proposed oil shale recov-

ery projects, the quality of the pillars and ribs which must carry the overburden bears directly upon their dimensions with respect to room size and thus extraction ratios. Pre-splitting by various specialized blasting techniques has been shown to significantly improve the mechanical quality of the rock not excavated by blasting operations. The development and application of pre-splitting techniques particularly suited to oil shale mining operations could have a significant impact upon the economics of oil shale recovery. "Fracture Control Blasting" is used to define blasting operations in which notched hole techniques are employed to provide some type of pre-split control on breakage. Both laboratory and field tests have demonstrated several features of fracture control blasting which could be applied to oil shale. Mechanical hole notching techniques have been demonstrated in a small pilot tunnel and evaluated in oil shale. Water jet and explosive hole notching techniques have been developed but not yet tested in oil shale. In tests in oil shale it was found that notched boreholes would enable contour or pre-split type fractures to be developed against in-situ stress or joint conditions, where such fractures could not be developed with unnotched holes. Although the important parameters in fracture control blasting have been identified, additional work is still required to establish the best methods for application to oil shale mining.

0404 Oil Production, Recovery, And Refining

REFER ALSO TO CITATION(S) 04040049503

49496 **(DOE/FE/60177—1664) Investigation of tracer tests on the Western Research Institute 10-ton retort.** Turner, T.F.; Moore, D.F. (Western Research Inst., Laramie, WY (USA)). May 1984. Contract FC21-83FE60177. 42p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85001459.

An oil shale rubble bed with contrasting permeability regions is investigated using a gas tracer in conjunction with a two-dimensional flow and tracer model and with a one-dimensional dispersion model. Six runs on the retort are discussed. Tracer injections are made into the main flow inlet and into five taps near the top of the retort. Detection taps are located at four levels in the retort with five taps on each level. The one-dimensional dispersion model is fit to the tracer response curves producing estimates of dispersion and space time in the retort. The dispersion model produces reasonable estimates where the fluid flow deviates only slightly from vertical. The two-dimensional flow model developed by Travis at Los Alamos National Laboratory (LANL) is compared to tracer velocities. The correlation between the model and the data is good in the last of the six tests. The correlation is not as good in the earlier tests and possible reasons for this are discussed.

49497 **Combined fluidized bed retort and combustor.** Shana, J.Yu.; Mei, J.S.; Notestein, J.E.; Zeng, L.W. (to Dept. of Energy). US Patent 4,447,297. 8 May 1984. Filed date 14 Apr 1982. vp.

PAT-APPL-368197.

The present invention is directed to a combined fluidized bed retorting and combustion system particularly useful for extracting energy values from oil shale. The oil-shale retort and combustor are disposed side-by-side and in registry with one another through passageways in a partition therebetween. The passageways in the partition are submerged below the top of the respective fluid beds to preclude admixing or the product gases from the two chambers. The solid oil shale or bed material is transported through the chambers by inclining or slanting the fluidizing medium distributor so that the solid bed material, when fluidized, moves in the direction of the downward slope of the distributor.

49498 **Battelle's Multi-Solid Fluidized Bed Oil Shale Retort.** Shirley, F.W.; Appelbaum, H.R.; Steedman, W.G. (Battelle Columbus Laboratory, Columbus, OH). pp 83-102 of Proceedings 1983 Eastern Oil Shale Symposium. Lexington, KY, USA; Univ. of Kentucky, IMMR (1983). (CONF-831123—).

From Eastern oil shale symposium; Lexington, KY, USA (13 Nov 1983).

Battelle is developing the Multi-Solids Fluidized Bed (MSFB) Oil Shale Retort under contract to the U.S. Department of Energy. This retort features an entrained bed of small particles (spent shale) superimposed on a permanently fluidized bed of large dense particles. The heat required for retorting is supplied by burning retorted shale in a separate fluidized bed and is delivered to the retort by the recirculating entrained bed. This paper describes the development effort and discusses the major experimental results of the ongoing effort.

49499 **The importance of hydrogen donors in the solvent conversion of eastern shale.** Cronauer, D.C.; Danner, D.A.; Galya, L.G.; Solash, J. (Gulf Research and Development Co., Pittsburgh, PA). pp 17-23 of Proceedings 1983 Eastern Oil Shale Symposium. Lexington, KY, USA; Univ. of Kentucky, IMMR (1983). (CONF-831123—).

From Eastern oil shale symposium; Lexington, KY, USA (13 Nov 1983).

Hydrogen donor solvents play a significant role in converting Eastern U.S. shale to liquid products. Good hydrogen donor solvents can convert up to 70% of Cleveland Member, Ohio Shale to toluene-soluble products. Use of poor hydrogen donor solvents results in converting only 35% of this shale to toluene-soluble products. A number of variables affect the conversion of Eastern U.S. shale to soluble products. The results of changing temperature, solvent type, and time are discussed. The fate of solvent tetralin is also discussed.

49500 **Design of a field experiment for air-steam co-injection for oil recovery in a Utah tar sand.** Lasaki, G.O.; Martel, R.; Fahy, L.J. *SPE (Society of Petroleum Engineers of AIME) Reprint Series;* **57**: vp(1982). (CONF-820927—).

From 57. AIME Society of Petroleum Engineers annual technical conference and exhibition; New Orleans, LA, USA (26 Sep 1982).

The deisgn of the US DOE Laramie Energy Technology Center's Project TS-4 which involves both in situ reverse combustion and steamflooding, using a numeric simulator, is described. The simulator showed that the combustion could be limited and contained in a middle 10 ft interval with a correlatable high permeability streak within the 65-ft pay zone of the upper Rimrock tar sand formation in NW Asphalt Ridge, Uintah County, Utah. A high transmissibility path was assumed to obtain adequate injectivity and sustain a stable reverse combustion. Combustion echoes developed and the front changed into a forward mode as the formation pressure increased and at very low air-injection rates. Oil recovery was accelerated by pre-heating the formation with the combustion before steamflooding the entire sand. 11 references.

0405 Properties And Composition

REFER ALSO TO CITATION(S) 04050049506

49501 **Dielectric properties of oil shale materials.** Inguva, R.; Rajeshwar, K. (Department of Physics and Astronomy, University of Wyoming, Laramie, Wyoming). pp 311-319 of Proceedings 1983 Eastern Oil Shale Symposium. Lexington, KY, USA; Univ. of Kentucky, IMMR (1983). (CONF-831123—).

From Eastern oil shale symposium; Lexington, KY, USA (13 Nov 1983).

A systematic study of the many variables (other than the organic content) which could possibly influence the dielectric properties of the oil shales is carried out. The relative importance of such parameters in assay applications of dielectric spectroscopy is investigated. The influence of chemical changer in the oil shale matrix of the dielectric behavior of oil shales is studied.

49502 **Physiochemical characterization of the Devonian Chattanooga Shale in North Alabama and South-Central Tennessee.** Rheams, K.F.; Neathery, T.L. (Geological Survey of Alabama, University of Alabama). pp 151-160 of Proceedings 1983 Eastern Oil Shale Symposium. Lexington, KY, USA; Univ. of Kentucky, IMMR (1983). (CONF-831123—).

From Eastern oil shale symposium; Lexington, KY, USA (13 Nov 1983).

A four-county area in north Alabama and southcentral Tennessee has been defined as having the best oil potential of the Devonian Chattanooga Shale in the southernmost part of the Highland Rim Section. Geochemical analyses of approximately 65 shale samples from the area have been integrated with nondestructive determinations to present a more accurate characterization of the oil shale and to help assess the shale's overall resource potential. The shale has an average oil yield of 13.9 g/t, although some samples will yield up to 23 g/t. Total organic carbon averages 16.27 wt.% with a hydrocarbon index of 323 mg/g. Free hydrocarbon content of the rock averages 2.33 mg/g with a residual hydrocarbon potential of 52.58 mg/g. Solid state ^{13}C NMR spectra of selected shale samples indicate that the shale contains an average of 0.51 aliphatic carbon, of which 0.25 appears to be convertible to oil. Variation between samples is interpreted to be a reflection of the quality of the organic matter present rather than the total organic carbon content.

49503 **Nitrogen compound distribution in Eastern and Western U.S. shale oils produced by hydropyrolysis.** Holmes, S.A.; Thompson, L.F. (Laramie Energy Technology Center, U.S. Department of Energy, Laramie, Wyoming). pp 85-99 of Proceedings 1982 Eastern Oil Shale Symposium. Lexington, KY, USA; Univ. of Kentucky (1982). (CONF-8210274—).

From Symposium on eastern oil shale; Lexington, KY, USA (11 Oct 1982).

Nitrogen compound distributions are presented for eastern (Devonian and Mississippian) and western (Eocene) U.S. shale oils produced from the corresponding shales by the IGT Hytort hydropyrolysis process. The nitrogen compound distributions in the oils were determined by adsorption chromatography, infrared spectroscopy, and mass spectrometry. Differences in the nitrogen compound distributions in the oils were dependent upon the geographic origin of the oil shale. ^{1}H and ^{13}C high-resolution NMR data showed that concentrations of aromatic carbon and hydrogen were greater in the eastern oils than in the western shale oil. This greater aromaticity of the eastern shale oils was also reflected by the greater concentrations of more aromatic nitrogen compounds. Potentiometric titration data and total nitrogen content data indicated that eastern shale oils contained greater amounts of nonbasic nitrogen compounds, especially alkylindoles and alkylcarbazoles, than did the western shale oil. The effect of a reductive atmosphere (hydrogen) during hydropyrolysis of the western oil shale allowed greater amounts of sterically hindered, alkylpyridine-type compounds in the oils. Based on data presented, different refining conditions may be necessary to effectively remove nitrogen in the production of transportation fuels from shale oils of different geographic sources.

0408 Marketing And Economics

49504 **(DOE/RG/03365—T1) Review and evaluation of costs and benefits from various oil shale strategies. Final report.** (Kearney (A.T.), Inc., Alexandria, VA (USA)). 28 Nov 1980. Contract AM01-78RG03365. 79p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85000459.

The first objective of this study is to compare and contrast the revenue streams that would accure to public treasuries from hypothetical oil shale and petroleum production operations. The second objective is to analyze five incentive mechanisms targeted toward oil shale development and determine the attractiveness of each incentive from the investor's and the governments standpoint. The five incentives considered in this study are: (1) Alternative Energy Production Credit (2) Capital Recovery Act 1979 (3) Price support (4) Guaranteed Purchase and (5) the Additional 10% Investment Tax Credit. In the absence of Federal incentives, public revenues from petroleum production exceeded the revenues from oil shale production. The revenue difference between the two processes was due to the depletion allowance and the higher operating costs associated with an oil shale operation. When comparing each oil shale incentive mechanism and assuming that all costs escalated at the same rate in the future, the Capital Cost Recovery Act and the Additional 10% investment tax credit provide the greatest increase in project discounted cash flow rate of return for a given net present value cost to the Federal Government. If the market price of oil shale increases at an assumed rate of 2.5% per year faster than inflation, then the price support and guaranteed purchase incentives are the most attractive from the government's standpoint. These incentives would even provide the government with a net positive return. From the project sponsor's standpoint the price support and guaranteed purchase incentives increases project economics favorably and reduces the risk involved in proceeding with the project due to price uncertainties.

0409 Waste Research And Management

REFER ALSO TO CITATION(S) 04090049399

0410 Enviromental Aspects

49505 **(PB—84-211283) Characterization of oil shale mine waters, central Piceance Basin, Colorado. Final report.** Kelly, K.E.; Dederick, J.D. (Kaman Tempo, Denver, CO (USA)). Jun 1984. 82p. NTIS, PC A05/MF A01.

A study was conducted to characterize the oil shale mine waters in the Piceance Basin. The study sites were Federal Prototype Lease Tracts C-a and C-b, located in the central portion of the basin. The objective was to collect water quality data in order to characterize the mine waters and to assess the effectiveness of treatment systems located at these facilities. These treatment systems involve in-series retention ponds. The overall conclusion with respect to the effectiveness of the retention pond systems in maintaining or improving water quality is that they appear to make negligible difference unless chemicals are added. The addition of the flocculent during periods of active mining was very effective in reducing the suspended sediment concentrations. In addition, sulfuric acid treatment reduced the pH. Concerning the general water quality, such as the trace elements, cations and anions, and other pertinent constituents, there was not a significant increase or decrease due to the chemical additives. In addition, the effectiveness of the one-pond and two-pond systems are very similiar.

49506 **The reactivity of pyrite in raw eastern oil shale and its transformation during processing.** Paciorek, K.L.; Atkins, H.M.; Kimble, P.F.; Kratzer, R.H.; Masuda, S.R.; Westhoff, J. (Ultrasystems Inc., Irvine, CA). pp 281-286 of Proceedings 1983 Eastern Oil Shale Symposium. Lexington, KY, USA; Univ. of Kentucky, IMMR (1983). (CONF-831123—).

From Eastern oil shale symposium; Lexington, KY, USA (13 Nov 1983).

The objective of the program was to assess the potential environmental hazard posed by the surface disposal of raw and spent eastern oil shales. Three shales: Sunbury, Cleveland, and New Albany were investigated. The spent materials were derived in the case of the Sunbury shale from the Battelle, in the case of the Cleveland shale from the Rockwell, and in the case of the New Albany shale from the Hytort process. The raw, low carbonate Sunbury and Cleveland shales were found to produce acid drainage readily on exposure to the atmosphere and water; this action was accelerated by iron oxidizing bacteria. The raw New Albany shale behaved in a manner analogous to highly calcareous coals. No pyrite appeared to be left in the spent shales; the presence of ferrous sulfide in the New Albany and Cleveland shales was indicated. Mechanisms responsible for the results obtained are discussed.

05 NUCLEAR FUELS

0502 Exploration

REFER ALSO TO CITATION(S) 05020049525

0503 Mining

49507 (CNSNS—0004((Vol.1,2)) **Mining-metallurgical projects for the production of uranium concentrates.** Ajuria-Garza, S. (Comision Nacional de Seguridad Nuclear y Salvaguardias, Mexico City). 1983. 310p. (In Spanish). NTIS (US Sales Only), PC A14/MF A01. File Number DE84703129.

This report presents an overall view of a complete project for a mining-metallurgical complex for the production of uranium concentrates. Relevant aspects of each important topic are discussed as parts of an integrated methodology. The principal project activities are analyzed and the relationships among the various factors affecting the design are indicated. A list of 96 principal activities is proposed as an example. These activities are distributed in eight groups: initial evaluations, preliminary feasibility studies, project engineering, construction, industrial operation, decommissioning and post-decommissioning activities. The environmental impact and the radiological risks due to the construction and operation of the mining metallurgical complex are analyzed. The principles of radiological protection and the regulations, standards and recommendations for radiological protection in uranium mines and mills are discussed. This report is also a guide to the specialized literature: a bibliography with 765 references is included.

0504 Feed Processing

REFER ALSO TO CITATION(S) 05040049507, 49513, 49514, 49525

49508 (GKSS—82/E/57) **Influence of adsorber performance on plant design for the extraction of uranium from seawater.** Koske, P.H.; Ohlrogge, K. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1983. 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84751538.

Based on simple seawater and dissolved uranium balances the influence of specific adsorber parameters on size and design of production plants with fluidized adsorber beds for the extraction of uranium from seawater is discussed. Besides a critical review of two recently published plant designs in the USA and Japan experimentally determined adsorber data for a polyamidoxime (PAO) granulate are presented together with an evaluation of their influence on the key plant parameters.

49509 (DOE-tr—4017301) **Technological-economic considerations of the production of uranium by the amalgam process.** Stoll, W. Translated from *Atompraxis ;* **8**: No. 3, 93-94(1962). 6p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017301. DE84017301

It is not known in detail what refinement time is currently available to individual producers of uranium metal for their refinement from concentrate to metal. It is also doubtful whether any new production units will be formed anywhere with continuance of the market situation at the moment. It seems in order, however, to call the attention of the reader to the new process with the indication that, in combination with already existing alkali-chloride electrolysis between 10% and 20% of the cost of refinement of the concentrate to the metal can be saved.

0505 Enrichment

REFER ALSO TO CITATION(S) 05050049524, 49569

49510 (KFK—3665) **Investigations into the operating behavior of separation nozzle cascades for uranium-235 enrichment in a 10-stage pilot plant.** Camara, A.S.; Consiglio, R.; Yadoya, R.; Bley, P.; Hein, H.; Linder, G. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kernverfahrenstechnik). Mar 1984. 19p. (In German). NTIS (US Sales Only), PC A02/MF A01. File Number DE84751916.

The separation nozzle method developed by the Karlsruhe Nuclear Research Center is based on the centrifugal force in a curved jet consisting of uranium hexafluoride and a light auxiliary gas. To determine in experiments the operating and controlling behavior of separation nozzle cascades a 10-stage pilot plant was erected some years ago. This plant was transferred to the Centro de Desenvolvimento da Tecnologia Nuclear (CDTN) in Belo Horizonte as a donation made within the framework of the German-Brazilian Agreement on scientific cooperation in the field of uranium enrichment. The plant previously equipped with single deflection systems was modified to operate with the double deflection system envisaged for commercial plants. A controlling concept meanwhile developed and improved for separation nozzle cascades equipped with single and double deflection systems was verified experimentally and optimized at the pilot plant of the CDTN. A comparison of the experimental operating behavior with the operating behavior calculated by simulation programs has confirmed the faithfulness of simulation of the computer codes developed to apply to cascades with double deflection systems as well.

49511 (KFK—3732) **Accuracy of X-ray lithography using synchrotron radiation for the fabrication of technical separation nozzle elements.** Becker, E.W.; Ehrfeld, W.; Muenchmeyer, D. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kernverfahrenstechnik; Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Maschinenbau). Apr 1984. 92p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE84752164.

As a method for the fabrication of technical separation nozzle elements with extremely small characteristic dimensions, the Institut fuer Kernverfahrenstechnik of the University and the Nuclear Research Centre of Karlsruhe in co-operation with the Siemens AG, Munich, and the Fraunhofer Institute for Solid-State Technology, Munich, are developing the LIGA-process. In this process, poly(methylmethacrylate) layers of an approximate thickness of 0.5 mm are structured by means of X-ray depth-lithography using synchrotron radiation. Subsequently, the nozzle structures are electroformed with nickel using the PMMA-layers as a mould. The manufacturing precision which can be obtained by X-ray depth-lithography was investigated by means of computer simulation of both the irradiation and the development step. In the first step the precision is limited by diffraction, photoelectrons, and beam divergency, respectively. It is shown, that under appropriate conditions each of these effects contributes only some 0.1 μm to errors at the structure edges. The simulation of the development step is based on experiments on the dissolution properties of both irradiated and unirradiated PMMA in a special developing agent. From the results of the computer simulation it can be seen, that the ratio of the slit length to the smallest width which is required for the fabrication of separation nozzles and the required precision are already obtainable in the one-step lithographic process at a characteristic wavelength of 0.2 nm. If an extreme structure height in combination with high precision is required or if a radiation source with a longer characteristic wavelength has to be used, the multi-step process can be applied. The calculations may easily be adapted to different manufacturing parameters concerning the radiation source or the developer characteristic.

49512 **Uranium enrichment policy. Hearings before the Subcommittee on Energy Conservation and Power of the Committee on Energy and Commerce, House of Representatives, Ninety-Eighth Congress, October 21, 1983 and March 1, 1984.** Washington, DC, USA; Government Printing Office (1984). 450p.

Decreasing revenues from the sale of enriched uranium will affect DOE budgeting, which has allotted 20% to the enrichment program. Two days of hearings brought testimony from labor, research institutes, utilities, and the nuclear industry on the effort to stabilize enrichment services in line with the current market situation. The reassessment is necessary to determine the timing of DOE's construction of facilities. At issue was the loss of 35% of the US market share to foreign competition. The first day's witnesses were asked to focus on market aspects rather than on technologies. Testimony on the second day focused on DOE's budget request of over $1.8 million for uranium enrichment and DOE's conflict with the Tennessee Valley Authority over the cost of long-term contracts that require the purchase of more power than DOE currently needs. Material submitted for the record follows the testimony of 18 witnesses.

0507 Fuels Production And Properties

REFER ALSO TO CITATION(S) 0507049842

49513 **(GKSS—83/E/73) Absorber loop concept for the contact between seawater and adsorber granulate.** Koske, P.H.; Ohlrogge, K. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1984. 16p. (CONF-831095—3). NTIS (US Sales Only), PC A02/MF A01. File Number DE84751926.

From International meeting on recovery of uranium from seawater; Tokyo, Japan (17 Oct 1983).

The present paper deals with the so-called "adsorber loop concept" in which the adsorber granulate is carried along with the seawater to be processed in a loop-like configuration and is separated again from the depleted water before this is leaving the adsorption unit. This concept enables high seawater velocities thus reducing the required bed area. Theoretical considerations are presented together with experimental results from field tests.

49514 **(GKSS—83/E/74) Design of a modular pilot plant based on the adsorber loop concept.** Koske, P.H.; Ohlrogge, K. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1984. 14p. (CONF-831095—2). NTIS (US Sales Only), PC A02/MF A01. File Number DE84751914.

From International meeting on recovery of uranium from seawater; Tokyo, Japan (17 Oct 1983).

The main design criteria for a pilot plant producing about 100 t uranium per year from seawater are discussed. The application of the "adsorber loop concept" for the contact between seawater and the adsorber granulate enables the employment of high seawater velocities. The seawater flow is accomplished by active pumping and the plant is supposed to be operating far from shores. Besides some information on the theoretical background the essential engineering considerations are presented.

0508 Spent Fuels Reprocessing

49515 **(CONF-840793—2) Dual arm master controller concept.** Kuban, D.P.; Perkins, G.S. (Oak Ridge National Lab., TN (USA); Jet Propulsion Lab., Pasadena, CA (USA)). 1984. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001901.

From USDOE/ORNL/PNC national topical meeting on robotics and remote handling in hostile environments; Tokyo, Japan (24 Jul 1984).

The Advanced Servomanipulator (ASM) slave was designed with an anthropomorphic stance, gear/torque tube power drives, and modular construction. These features resulted in increased inertia, friction, and backlash relative to tape-driven manipulators. Studies were performed which addressed the human factors design and performance trade-offs associated with the corresponding master controller best suited for the ASM. The results of these studies, as well as the conceptual design of the dual arm master controller, are presented. 6 references, 3 figures.

49516 **(CONF-840793—5) Automatic camera tracking for remote manipulators.** Stoughton, R.S.; Martin, H.L.; Bentz, R.R. (Tennessee Univ., Knoxville (USA); Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC05-84OR21400. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001897.

From USDOE/ORNL/PNC national topical meeting on robotics and remote handling in hostile environments; Tokyo, Japan (24 Jul 1984).

The problem of automatic camera tracking of mobile objects is addressed with specific reference to remote manipulators and using either fixed or mobile cameras. The technique uses a kinematic approach employing 4 x 4 coordinate transformation matrices to solve for the needed camera PAN and TILT angles. No vision feedback systems are used, as the required input data are obtained entirely from position sensors from the manipulator and the camera-positioning system. All hardware requirements are generally satisfied by currently available remote manipulator systems with a supervisory computer. The system discussed here implements linear plus on/off (bang-bang) closed-loop control with a +-2-deg deadband. The deadband area is desirable to avoid operator seasickness caused by continuous camera movement. Programming considerations for camera control, including operator interface options, are discussed. The example problem presented is based on an actual implementation using a PDP 11/34 computer, a TeleOperator Systems SM-229 manipulator, and an Oak Ridge National Laboratory (ORNL) camera-positioning system. 3 references, 6 figures, 2 tables.

49517 **(DPST—84-1-6) Savannah River Laboratory monthly report, June 1984.** (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1984. Contract AC09-76SR00001. 14p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84017093.

Reported are: acid hydrolysis of tetraphenylborate precipitates, chemical equilibrium calculations, decontamination and disassembly demonstration, fault tree data bank for reactors, improved assembly endfitting design, radiation effects on reactor materials, dissolution of residues from plutonium electrorefining, flexible fiberoptic borescopes, radiological effect of SRP operations, and underground low-level counting facility.

49518 **(Juel—1899) Aqueous chemical reprocessing of HTR fuel.** Merz, E.; Zimmer, E. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Chemische Technologie der Nuklearen Entsorgung). Feb 1984. 42p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84752162.

The THOREX process has been developed for reprocessing uranium and thorium from thorium-based fuel. Several flowsheet variants with acid and acid deficient feed solutions, respectively have been investigated in the past. In order to achieve high decontamination factors, a dual cycle THOREX process was developed. This process uses an acid feed solution in the first cycle and an acid deficient one in the second cycle. According to recent investigations, a single cycle process with acid feed solution should provide the necessary decontamination factors. An immediate separation of thorium and uranium appears advisable in view of both fuel cycle strategy and process feasibility. Pulse columns should be preferentially used as extraction apparatus, at least for the extraction step. Reprocessing of HTR-LEU fuel in existing PUREX plants is bothered with problems of criticality prevention due to the residual total fissile isotope content in the feed of greater than 2%. Special precaution must therefore be taken in several processing units. A more suitable method to overcome criticality difficulties may be the application of a flow sheet with lower TBP concentrations in the range of less than 10%. Beyond it, there are no further problems to consider with LEU fuel reprocessing.

49519 (KFK—3617) Decontamination of carbonate containing process streams in a reprocessing plant by chromatography. Faubel, W.; Menzler, P.M.; Sameh, A.A. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Radiochemie; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Wiederaufarbeitung und Abfallbehandlung). Feb 1984. 33p. (In German). (PWA—84/83). NTIS (US Sales Only), PC A03/MF A01. File Number DE84751917.

Results of a new procedure are presented to decontaminate carbonate process streams containing fission products and actinides occurring in burned up fuel elements combining a filtration and chromatographic step. First the unsoluble or hydrolysed plutonium and fission product species are separated by a filter mounted in front of a Bio-Rex 5 resin column which fixes all activities remaining in the filtrate. The solution passing the column is decontaminated greater than 99%. The recovery of the actinides and fission products from the resin and the filter is performed by 4 M nitric acid.

49520 (KFK—3670, pp 233-255) Modelling of the off-gas-cleaning system of the planned reprocessing plant as a basis for a safety analysis. Nagel, K.; Wenzelburger, H.; Furrer, J.; Ammon, R.V. Feb 1984. (In German). NTIS (US Sales Only), PC A12/MF A01. File Number TI84751925. (CONF-8311169—).

From Annual colloquium of the nuclear safety project; Karlsruhe, F.R. Germany (21 Nov 1983).

Incidents for off-gas cleaning system installed in the Nuclear Research Center Karlsruhe (KfK) are investigated. For PASSAT, a facility that removes aerosols and iodine isotopes from the off-gas, a stochastic model has been developed. The model needs experimental data in an analytical approximation. With given operation and repair strategies the model allows predictions for mean release of radioactive iodine. Prediction for released aerosols are not yet possible, for we do not know the total amount as well as the spectral distribution of aerosols from the dissolver. The results of the model are interpreted qualitatively with regard to a planned large reprocessing plant. The facilities ADAMO and KRETA removing Kr-85 from the off-gas have been investigated in order to reveal their most important failures. It is possible to describe the operation of ADAMO regarding the time-dependent adsorption of H_3O and CO_2 as well as the coadsorption of krypton and xenon in silica gel and molecular sieve. The time-dependent presentation of the krypton rectification in KRETA needs further research.

49521 (KFK—3673) Dissolution of unirradiated UO_2-pellets in nitric acid. Herrmann, B. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Heisse Chemie; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Wiederaufarbeitung und Abfallbehandlung; Heidelberg Univ. (Germany, F.R.). Fakultaet fuer Chemie). Feb 1984. 197p. (In German). (PWA—94/83). NTIS (US Sales Only), PC A09/MF A01. File Number DE84751915.

Kinetics of dissolution of UO_2-pellets in nitric acid and the gaseous reaction products, N_2O, NO, NO_2 are determined for different temperatures and acid concentrations. NO_2:NO ratio increases with temperature and nitrate concentration. The amount of N_2O formed increases with temperature and acid concentration. At 90°C and dissolution in 12 m nitric acid 1l weight-% of UO_2 are dissolved forming N_2O. The oxidation of UO_2 takes place on the crystal surface or at the interface UO_2/HNO_3. U(IV)-ions cannot be detected in the solution. The nitrous acid resulting from reduction of HNO_3 or the species which is in equilibrium with nitrous acid e.g. the nitrosyl-ion is responsible for UO_2-oxidation.

49522 (ORNL-tr—5162) Brief description of the Wackersdorf reprocessing installation. (Oak Ridge National Lab., TN (USA); Deutsche Gesellschaft fuer Wiederaufarbeitung von Kernbrennstoffen m.b.H. (DWK), Hannover (Germany, F.R.)). 1983. Contract AC05-84OR21400. Translation source information not available . 106p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85000088.

This description covers the site, the techniques and experiences in the processing of nuclear fuels, structure and function of the planned installation, safety provisions for the planned plant and control of accidents, the effects of the plant and its operation on the surrounding area, measures for the removal of the radioactive waste, and measures for the final shutdown of the plant. 37 figures, 8 tables.

0509 Transport And Storage

REFER ALSO TO CITATION(S) 05090049559, 49571

49523 (PNL-SA—12398) Dry storage of LWR spent fuel in the US: a status report. Newman, D.F. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1984. Contract AC06-76RL01830. 4p. (CONF-840734—22). NTIS, PC A02/MF A01; GPO Dep. File Number DE85000398.

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

Dry storage is emerging as an important alternative to wet storage for management of LWR fuel. Dry storage is modular, passive, and can be implemented on a relatively short lead time, once it has been licensed. Thus, it is attractive for United States utilities which are nearing the limit of wet storage capacities. Dry storage of irradiated fuel has already been licensed in several countries. In the United States, dry storage concepts, including dry wells, silos (sealed concrete casks) and vaults, have been tested by the Department of Energy (DOE). Actions are also underway, in cooperation with utilities, to conduct additional unlicensed tests on metal storage casks at DOE facilities and to demonstrate licensed dry storage in metal casks and concrete silos at utility sites. It is anticipated that the demonstrations will confirm that there are no technical barriers that could prevent implementation of dry storage at reactor sites when needed. 6 references, 2 figures.

0510 Marketing And Economics

REFER ALSO TO CITATION(S) 05100049512

49524 (GAO/RCED—84-190) Information on repayment of the government's uranium enrichment program costs and audits of that program's financial statements. Peach, J.D. (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 10 Aug 1984. 16p. General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760. File Number TI85900096.

This letter responds to Rep. Richard Ottinger's question concerning repayment of the government's enrichment program costs and audits of the program's financial statements. An overview of the Department of Energy's Uranium Enrichment Program is given.

49525 (GKSS—83/E/75) Some economic considerations for a pilot plant based on the adsorber loop concept. Koske, P.H.; Ohlrogge, K.; Jager, W. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1984. 14p. (CONF-831095—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE84751912.

From International meeting on recovery of uranium from seawater; Tokyo, Japan (17 Oct 1983).

Some first order estimates about the production costs of seawater uranium are presented on the basis of a pilot plant with a capacity of about 100 t uranium per year. The plant is assumed to be operating at high seas using the "adsorber loop concept" for the contact between seawater and adsorber granulate. The effects of some process relevant components and parameters are discussed with regard to their contribution to the production costs and in order to analyse their cost-cutting potential.

0520 Waste Management

REFER ALSO TO CITATION(S) 05200049564, 49566, 49567, 49568, 49571, 50367, 50577, 50598, 50665, 50667

49526 (AERE-G—2897) Radionuclide source term and migration. Progress report April 1983 - September 1983. Chidley, B.E.; Ewart, F.T.; Smith, A.J.; Thomason, H.P. (UKAEA Atomic Energy Research Establishment, Harwell. Chemical Technology Div.). Dec 1983. 9p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703166.

Progress in two types of experiment is reported. In the first the equilibrium and concentration of radionuclides in groundwater in contact with real radioactive wastes are measured. Container material, backfill material and rock are added to groundwater to investigate their effects. In the second experiment the retardation of radionuclides leached from wastes as groundwater flows over samples of container, backfill and geological material is measured. Outflow is analysed for radionuclides and experimental results for cesium 134, cesium 137 and cobalt 60 are presented.

49527 (AERE-G—2945) Programme of research into the management and storage of radioactive waste. Fracture hydrology - Cornwall. Annual report 1983. Heath, M.J. (UKAEA Atomic Energy Research Establishment, Harwell. Chemical Technology Div.). Jan 1984. 2p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703167.

Pilot tests have been carried out on fractures intersecting two boreholes drilled in granite in a Troon quarry. The rate of recovery of water from one borehole as it is injected into the first has been measured. Tracer tests were carried out using potassium iodide and strontium nitrate. Samples were collected and analysed by absorption spectrophotometry.

49528 (AERE-G—2947) Programme of research into the management and storage of radioactive waste. Radionuclide source term and migration. Annual report 1983. Chidley, B.E.; Ewart, F.T.; Smith, A.J. (UKAEA Atomic Energy Research Establishment, Harwell. Chemical Technology Div.). Jan 1984. 2p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703168.

Progress in two experiments is reported. In the first the equilibrium speciation and the concentration of radionuclides in ground water, in contact with real wastes from reprocessing, is measured. In the second the retardation of radionuclides leached from waste as groundwater flows over the waste container and surrounding geological material is measured.

49529 (AERE-G—2950) Programme of research into the management and storage of radioactive waste. Mathematical modelling. Annual report 1983. Rae, J. (UKAEA Atomic Energy Research Establishment, Harwell. Theoretical Physics Div.). Jan 1984. 4p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703169.

Progress in work on the importance of fractures in rocks to waste disposal studies is reported. The permeability of the fracture system is predicted. Computer programmes are used to solve problems of ground water flow and radionuclide transport, and a new 'dual porosity' mathematical model is assessed for radionuclide transportation.

49530 (AERE-G—2957) Uranium series disequilibrium measurements at MOL and Whiteshell. Annual progress report for 1983. Ivanovich, M.; Wilkins, M.A. (UKAEA Atomic Energy Research Establishment, Harwell. Nuclear Physics Div.). Jan 1984. 5p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703170.

The current contract is funding two parallel uranium series disequilibrium studies and the aims of and the progress to date of these studies are given in this report. The larger study is concerned with the measurement of uranium series disequilibrium in ground waters derived from sand layers above and below the Boom Clay formation at Mol in Belgium. For the 2 observation wells studied to date, the sand layers above the Boom Clay are characterised by low uranium content (< 0.01 dpm Kg^{-1}) while below the Boom Clay, the sand layers are characterised by low to moderate uranium content (0.02 to 0.2 dpm Kg^{-1}). There are marked uranium concentration differences below the Boom Clay at the two different sites. The second study will measure the ratio of ^{226}Ra and ^{228}Ra in large groundwater samples which have been scavenged by acrylic fibres impregnated with manganese oxide from the Underground Research Laboratory at Pinawa, Canada.

49531 (AERE-G—2963) Programme of research into the management and storage of radioactive waste. Aqueous phase transport through granitic rocks. Annual report 1983. Bradbury, M.H.; Green, A. (UKAEA Atomic Energy Research Establishment, Harwell. Chemical Technology Div.). Jan 1984. 3p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703171.

Three aspects of work on aqueous phase transport by diffusion through porous granites are considered (1) The formation factor and long range connectivity of pore structure. (2) The effect of degraded fissure surfaces on diffusion into the main pore structure. (3) Effect of overburden pressures at depth on diffusion rates. Experiments were conducted on Cornish carnmenellis granite.

49532 (AERE-G—2964) Corrosion studies on containment materials for vitrified high level nuclear waste. Annual progress report for 1983. Taylor, K.J.; Bland, I.D.; Marsh, G.P. (UKAEA Atomic Energy Research Establishment, Harwell. Materials Development Div.). Jan 1984. 5p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703172.

The general corrosion of carbon steels buried in granite or bentonite beds and saturated with synthetic granitic ground water is investigated. Corrosion rates were measured after 170 and 470 days, and pitting corrosion after 200hrs and 300hrs. Experiments to measure corrosion rates due to radiolysis of γ-radiated argon-purged ground water were also carried out. Results support the feasibility of using carbon steel packs for isolating high-level wastes for 500-1000 yrs.

49533 (AERE-G—2995) Programme of research into the management and storage of radioactive waste. Single fracture experiment at Chalk River. Annual progress report for 1983. Bourke, P.J. (UKAEA Atomic Energy Research Establishment, Harwell. Chemical Technology Div.). Jan 1984. 1p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703173.

A field experiment was carried out at Chalk river to measure the transport of bromine and strontium through a fracture in granite. Retardation of strontium transport by sorption onto the rock was also measured. Data was obtained for bromine but no useful data was obtained for strontium due to failure of the hydraulic equipment.

49534 (ANS—318) User's guide to the biosphere code BIOMOD. Kane, P. (Associated Nuclear Services, Epsom (UK)). May 1983. 53p. NTIS (US Sales Only), PC A04/MF A01. File Number DE84703176.

BIOMOD has been designed to interface with SYVAC, the function of which is to perform generic risk assessments on hypothetical repository-geosphere-biosphere combinations. The user's guide contains the detailed specifications for the models used, a description of the interim user-interface, a specification for required input and definition of output. Sources of error are indicated and reference is made to the database description and other documents issued relating to BIOMOD.

49535 (ANS—332) Development of the biosphere code BIOMOD: final report. Kane, P. (Associated Nuclear Services, Epsom (UK)). May 1983. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703177.

Final report is given to DOE on the development of the biosphere code BIOMOD. The work carried out under the contract is itemised. Reference is made to the six documents issued along with the final report. These consist of two technical notes issued as interim consultative documents, a user's guide and a programmer's

guide to BIOMOD, a database description, program test document and a technical note entitled "BIOMOD - preliminary findings".

49536 **(ANS-TN-J—249-1) Development of biosphere codes for use in assessment of the radiological impact of geological repositories for radioactive waste.** Coughtrey, P.J.; Kane, P.; Thorne, M.C. (Associated Nuclear Services, Epsom (UK)). Dec 1982. 108p. NTIS (US Sales Only), PC A06/MF A01. File Number DE84703174.

A statement of radiological protection criteria and measures of dose, forms the preface to a review of extant biosphere codes. Consideration is given to the implementation of the codes FOODII and NEPTUN for use with SYVAC. The selection of nuclides for consideration in SYVAC is discussed. Detailed specifications are provided for biosphere model developments desirable in the longer term.

49537 **(ANS-TN-J—249-3) BIOMOD - preliminary findings.** Kane, P. (Associated Nuclear Services, Epsom (UK)). Jun 1983. 31p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84703175.

Certain preliminary findings on the workings of the biosphere code BIOMOD are presented. These are intended as the basis for technical discussions relating to the development of BIOMOD1. Discussion is restricted to observations on the relationships between user-defined input and i) relative significance of different pathways for activity transfer to man, ii) total activity consumption by man, and iii) activity released to dose conversion factors to be used in SYVAC.

49538 **(BMI/ONWI—540) Summary of petrographic and chemical data for Palo Duro Basin samples examined by Bendix Field Engineering Corporation, Grand Junction, Colorado, as of April 29, 1983.** Fukui, L.M. (Bendix Field Engineering Corp., Grand Junction, CO (USA)). Aug 1984. Contract AC06-76RL01830;AC02-83CH10140. 104p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85000382.

Bendix Field Engineering Corporation performed petrographic and chemical analyses on selected samples from the Palo Duro Basin, Texas. Permian bedded salt in the basin is being evaluated as a candidate nuclear waste repository site. This report summarizes procedures, petrographic data, chemical data, and trends in these data. A total of 38 Unit 4 and Unit 5 salt samples from the Permian Lower San Andres Formation have been examined; in addition, 14 samples from outside the candidate salt horizons were analyzed. Petrographic data were gathered from thin-section analyses, bulk-rock x-ray diffraction, and clay-mineral analyses. Chemical data were derived from analyses of the water-soluble fraction. Samples from outside the salt horizons were also analyzed for whole-rock chemistry. 6 references, 5 figures, 3 tables.

49539 **(BMI/ONWI—545) Performance assessment plans and methods for the Salt Repository Project.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Aug 1984. Contract AC02-83CH10140. 350p. NTIS, PC A15/MF A01; 1; GPO Dep. File Number DE85000960.

This document presents the preliminary plans and anticipated methods of the Salt Repository Project (SRP) for assessing the postclosure and radiological aspects of preclosure performance of a nuclear waste repository in salt. This plan is intended to be revised on an annual basis. The emphasis in this preliminary effort is on the method of conceptually dividing the system into three subsystems (the very near field, the near field, and the far field) and applying models to analyze the behavior of each subsystem and its individual components. The next revision will contain more detailed plans being developed as part of Site Characterization Plan (SCP) activities. After a brief system description, this plan presents the performance targets which have been established for nuclear waste repositories by regulatory agencies (Chapter 3). The SRP approach to modeling, including sensitivity and uncertainty techniques is then presented (Chapter 4). This is followed by a discussion of scenario analysis (Chapter 5), a presentation of preliminary data needs as anticipated by the SRP (Chapter 6), and a presentation of the SRP approach to postclosure assessment of the very near field, the near field, and the far field (Chapters 7, 8, and 9, respectively). Preclosure radiological assessment is discussed in Chapter 10. Chapter 11 presents the SRP approach to code verification and validation. Finally, the Appendix lists all computer codes anticipated for use in performance assessments. The list of codes will be updated as plans are revised.

49540 **(CONF-840307—48) Perspective on demonstrations of compliance for high-level waste disposal.** Kocher, D.C.; Smith, E.D.; O'Kelly, G.D.; Sjoreen, A.L. (Oak Ridge National Lab., TN (USA); Union Carbide Corp., Oak Ridge, TN (USA). Nuclear Div.). 15 Mar 1984. Contract AC05-84OR21400. 19p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000989.

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

This paper discusses a perspective which we have developed on the problem of demonstrating compliance of high-level waste repositories with system performance standards. Our viewpoint arises from two primary concerns - first, that the US Environmental Protection Agency's proposed environmental standard for high-level waste disposal appears to require demonstrations of compliance which are incompatible with scientific knowledge, and, second, that the federal agencies involved in the licensing process may not appreciate fully the extent of unquantifiable and uresolvable uncertainty in repository performance-assessment models. We propose a general approach to demonstrations of compliance which we feel is compatible with the kinds of technical information that will be available for judging repository performance. Our approach emphasizes the importance of investigation alternative conceptual models and lines of reasoning in evaluating repository performance and the importance of subjective scientific judgment in the desision-making process. 24 references, 1 figure.

49541 **(CONF-8406205—1) Grouting of uranium mill tailings piles.** Boegly, W.J. Jr.; Tamura, T.; Williams, J.D. (Oak Ridge National Lab., TN (USA); Oak Ridge Y-12 Plant, TN (USA)). Mar 1984. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001278.

From National conference on environmental engineering; Los Angeles, CA, USA (25 Jun 1984).

A program of remedial action was initiated for a number of inactive uranium mill tailings piles. These piles result from mining and processing of uranium ores to meet the nation's defense and nuclear power needs and represent a potential hazard to health and the environment. Possible remedial actions include the application of covers to reduce radon emissions and airborne transport of the tailings, liners to prevent groundwater contamination by leachates from the piles, physical or chemical stabilization of the tailings, or moving the piles to remote locations. Conventional installation of liners would require excavation of the piles to emplace the liner; however, utilization of grouting techniques, such as those used in civil engineering to stabilize soils, might be a potential method of producing a liner without excavation. Laboratory studies on groutability of uranium mill tailings were conducted using samples from three abandoned piles and employing a number of particulate and chemical grouts. These studies indicate that it is possible to alter the permeability of the tailings from ambient values of 10^{-3} cm/s to values approaching 10^{-7} cm/s using silicate grouts and to 10^{-8} cm/s using acrylamide and acrylate grouts. An evaluation of grouting techniques, equipment required, and costs associated with grouting were also conducted and are presented. 10 references, 1 table.

49542 **(DOE/LLW—6Ta) Directions in low-level radioactive-waste management. Planning state policy on low-level radioactive waste.** (EG and G Idaho, Inc., Idaho Falls (USA)). Oct 1982. Contract AC07-76ID01570. 25p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000096.

The majority of states face a growing problem in the management of low-level radioactive waste generated within their borders. The current uncertainty regarding the availability of disposal sites for these waste products exacerbates their increasing generation rate. The purpose of this publication is to assist state governments in planning effective policy to address these problems. Background information is presented on the current situation, the responsibilities of state government, and the assistance available to

states from federal agencies and national groups. The document then focuses on state policy planning, including: (a) methodology for assessing a state's current waste management status and for projecting future needs, (b) consideration of waste management options for a state, and (c) insight into the possible effects and implications of planned policies. This information is intended primarily for state officials - executive, legislative, and agency - and does not include detailed technical information on waste characteristics or handling techniques.

49543 **(DOE/LLW—6Te) Directions in low-level radioactive-waste management. Incentives and compensation: providing resources for communities hosting low-level waste facilities.** (EG and G Idaho, Inc., Idaho Falls (USA)). Oct 1982. Contract AC07-76ID01570. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000920.

State responsibility for the management of low-level radioactive waste necessitates the selection of candidate locations for a disposal facility. Concern over potential impacts can be expected from segments of the citizenry neighboring a proposed site. A number of national organizations comprising state and local officials have recommended the use of incentives and compensation to help offset the negative local impacts. This document explores that concept. Discussion provides background information on potential local impacts from a low-level waste facility and considers the nature and types of incentives and compensation benefits that could be provided. The document then examines realistic options for planning and implementing the benefit program. This information is intended, primarily, to assist state officials - executive, legislative, and agency - in planning for and managing low-level waste disposal facilities.

49544 **(DOE/LLW—6Tf) Directions in low-level radioactive waste management. Low-level radioactive waste disposal: commercial facilities no longer operating.** Berlin, R.E.; Tuite, P.T. (Waste Management Group, Inc., White Plains, NY (USA)). Oct 1982. Contract AC07-76ID01570. 24p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000304.

This publication discusses three commercial facilities-no longer operating-that have received and now contain low-level radioactive waste. The facilities are located at West Valley, New York; Maxey Flats, Kentucky; and Sheffield, Illinois. All three of the facilities were selected and developed in the 1960s. The onset of water management problems caused the closure of the sites at West Valley and Maxey Flats in 1975 and 1977, respectively. Closure of the Sheffield site occurred in 1978, after the operator experienced site problems and consequent lengthy delays in its license renewal procedures. The document provides detailed explanation of the history, basis for closure, and current status of each facility. This information is intended, primarily, to assist state officials-executive, legislative, and agency-in planning for, establishing, and managing low-level waste disposal facilities.

49545 **(DOE/LLW—32T) Commission administration. National Low-Level Radioactive Waste Management Program.** (Southern States Energy Board, Atlanta, GA (USA); EG and G Idaho, Inc., Idaho Falls (USA)). Sep 1984. Contract FG07-83ID12434;AC07-76ID01570. 177p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE85001167.

This report is one in a series of commission option documents prepared for the US Department of Energy, designed to assist regional low-level waste compact commissions in their organization, administration and efforts to effectively manage waste within their regions. In particular, this report addresses topics related to commission administrative procedures, personnel, procurement and finance.

49546 **(DOE/LLW—33T) Commission operation. National Low-Level Radioactive Waste Management Program.** (Southern States Energy Board, Atlanta, GA (USA); EG and G Idaho, Inc., Idaho Falls (USA)). Sep 1984. Contract FG07-83ID12434;AC07-76ID01570. 27p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85000921.

Since Congress enacted the Low-Level Radioactive Waste Policy Act, the states have prepared to meet their responsibilities for management of low-level radioactive waste by entering into regional compacts. This option document is intended to provide a framework for the operation of a compact commission formed as the governing body of a low-level radioactive waste compact. This document is designed to be easily modified to meet the needs of various regional compacts. The ideas and format presented have been taken in general from the Federal Administrative Procedures Act, various state administrative procedures, and the state regulatory agencies' rules of procedure. The document is written from a legal perspective and, therefore, reflects certain requirements of filing, time frames, and standard language.

49547 **(DOE/LLW—34T) Commission enforcement. National Low-Level Radioactive Waste Management Program.** (Southern States Energy Board, Atlanta, GA (USA); EG and G Idaho, Inc., Idaho Falls (USA)). Sep 1984. Contract FG07-83ID12434;AC07-76ID01570. 13p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000922.

Under the terms of any compact for regional management of low-level radioactive waste, disputes may arise between parties to the compact, or a violation of the compact's terms may occur by a person, party state, or other legal entity. The purpose of this document is to suggest methods of: settling disputes between party states; handling adjudicatory violations of terms of the compact; and enforcing decisions of the commission. This document is intended to provide a model that can be easily expanded to meet particular needs of any compact commission. The document is written from a legal perspective and, therefore, reflects certain requirements of filing, time frames, and standard language. The ideas have been taken in general from the Federal Administrative Procedures Act, state administrative procedures, and various state regulatory agencies' rules of procedure. It is hoped this document will be of considerable assistance to compact commissions during formation of policies and procedures.

49548 **(DOE/TIC—3389-Suppl.1) High-level radioactive wastes. Supplement 1.** McLaren, L.H. (ed.). (USDOE Technical Information Center, Oak Ridge, TN). Sep 1984. 393p. NTIS, PC A17/MF A01; GPO Dep. File Number DE84013656.

This bibliography contains information on high-level radioactive wastes included in the Department of Energy's Energy Data Base from August 1982 through December 1983. These citations are to research reports, journal articles, books, patents, theses, and conference papers from worldwide sources. Five indexes, each preceded by a brief description, are provided: Corporate Author, Personal Author, Subject, Contract Number, and Report Number. 1452 citations.

49549 **(DP—83-125-3) Waste Management Program. Technical progress report, July-September 1983.** (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant; Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Aug 1984. Contract AC09-76SR00001. 237p. NTIS, PC A11/MF A01; 1; GPO Dep. File Number DE85000959.

This quarterly report provides current information on operations and development programs for the management of radioactive wastes from operation of the Savannah River Plant and off-plant participants. The studies on environmental and safety assessments, other support, in situ storage or disposal, waste form development and characterization, process and equipment development, transportation, transuranic waste management, low-level waste management, and the Defense Waste Processing Facility are a part of the Long-Term Waste Management Technology Program. The following studies are reported for the SR Interim Waste Operations: surveillance and maintenance, low-level effluent wastes, waste transfer, and process development. 42 references, 76 figures, 41 tables.

49550 **(ENEA-RT/PROT—83-17) Geologic disposal of radioactive waste. An in situ heating experiment in clay rock.** Tassoni, E.; Giulianelli, G.; Testa, L.; Bocola, W.; Girolimetti, G.; Giacani, G. (ENEA, Casaccia (Italy). Centro Ricerche Energia). 1983. 13p. (In Italian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703178.

The heat dissipation arising from the radioactive decay constitutes an important problem of the geological disposal of high level radioactive waste. A heating experiment was carried out in a clay quarry near Monterotondo (Rome), at 6.4 M in depth by means of a heater whose thermal power ranged from 250 to 500 watt. The experimental results fit well the theoretical values and show that the clay is a homogeneous and isotropic medium. The clay thermal conductivity, which was deducted by means of the "curve fitting" method, ranges from 0.015 to 0.017 watt/C.

49551 **(MG—84/1) Remote assessment of permeability/thermal diffusivity of consolidated clay sediments.** Lovell, M.A.; Ogden, P. (University Coll. of North Wales, Menai Bridge, Isle of Anglesey (UK). Marine Science Lab.). Feb 1984. 123p. NTIS (US Sales Only), PC A06/MF A01. File Number DE84703179.

The aim of this project was to examine the feasibility of predicting marine sediment permeability and thermal diffusivity by remote geophysical observations. For this purpose a modified consolidation cell was developed and constructed and tests on deep sea sediment samples carried out. Results and conclusions of a nineteen month programme are presented.

49552 **(OEFZS—4167) Design and operational experience with the off-gas cleaning system of the Seibersdorf incinerator plant.** Patek, P. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). May 1982. 58p. (AV—8/82). NTIS (US Sales Only), PC A04/MF A01. File Number DE84703164.

After a description of the design and the construction principles of the incinerator building, the furnace and its attached auxilary devices are explained. The incinerator is layed out for low level wastes. It has a vertical furnace, operates with discontinuous feeding for trashes with heat-values between 600 and 10000 kcal/kg waste. The maximum throughput amounts to 40 kg/h. The purification of the off-gas is guaranteed by a multistage filter system: 2 stages with ceramic candles, an electrostatic filter and a HEPA-filter system. The control of the off-gas cleaning is carried out by a stack instrumentation, consisting of an aerosol-, gas-, iodine- and tritium-monitor; the building is surveilled by doserate- and aerosol monitors. Finally the experiences of the first year of operation and the main problems in running the plant are described.

49553 **(OEFZS—4249) Considerations on the dimensioning of decay tanks for liquid radioactive wastes. Basic methods and examples.** Patek, P.; Krischan, J. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). Nov 1983. 61p. (In German). (AV—13/83). NTIS (US Sales Only), PC A04/MF A01. File Number DE84703165.

The treatment of radioactive liquid wastes with relative short halflives can be performed by decay or conditioning. Especially at medical plants for nuclear therapy the decay method is chosen very often. Generally decay tanks are constructed according to activity-input and volume of the liquid waste arisings. This paper tries to give help by a nomogramme and a calculator-programme for the lay-out of such a decay plant. Several examples are given for the nuclide ^{131}I.

49554 **(PNL—4937) Consideration of future climatic changes in three geologic settings.** Petrie, G.M. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1984. Contract AC06-76RL01830. 73p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85001704.

Staff at Pacific Northwest Laboratory are evaluating the potential for climatic change to affect the integrity of a nuclear waste repository at: (1) the Gibson Dome area of Utah; (2) the Palo Duro Basin of Texas; and (3) the Gulf Coast. Because a major assumption in this analysis is that a glacial age will recur, the climate of the last glacial period is examined for each location. Combining these paleoclimatic data with the current climatic data, each location is evaluated in light of the criteria given in Draft Revised General Guidelines for Recommendation of Sites for Nuclear Waste Repositories (10 CFR 960). The results of this analysis suggest that sites located in these areas are likely to meet the climate requirements set forth in the guidelines. However, further study is needed before a definitive statement can be made. In particular, modeling the effect of sea level change on the Gulf Coast groundwater system and obtaining an improved estimation for the increase in recharge during glacier times at the Texas and Utah locations would be useful. Several stragegies are presented for accomplishing this work. 94 references, 27 figures, 5 tables.

49555 **(PNL-SA—11908) Pump for metering high-level waste and glass former mixtures to an electric melter.** Blair, H.T.; Peterson, M.E. (Pacific Northwest Lab., Richland, WA (USA)). 1984. Contract AC06-76RL01830. 13p. (CONF-840802—21). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000400.

From ANS International topical meeting on fuel reprocessing and waste management; Jackson Hole, WY, USA (26 Aug 1984).

A pump was required for metering concentrated neutralized high-level liquid wastes mixed with glass formers to an electric melter for the nuclear waste vitrification process. An air-displacement slurry pump with a pneumatic actuated 2-way valve and microprocessor controller was found to best satisfy the requirements developed at the Pacific Northwest Laboratory (PNL). A 2-stage air lift was successfully used to meter slurries of acidic waste mixed with glass formers. Five candidate pumps were chosen for testing after an extensive review of commercially available pumps, present industrial practices, and the literature. Test procedures and results are described. 6 references, 4 figures.

49556 **(PNL-SA—12000) Off-gas treatment and characterization for a radioactive in situ vitrification test.** Oma, K.H.; Timmerman, C.L. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1984. Contract AC06-76RL01830. 20p. (CONF-840806—11). NTIS, PC A02/MF A01; GPO Dep. File Number DE85000358.

From 18. DOE nuclear airborne waste management and air cleaning conference; Baltimore, MD, USA (13 Aug 1984).

Effluents released to the off gas during the in situ vitrification (ISV) of a test site have been characterized by Pacific Northwest Laboratory. The site consisted of a 19 L waste package of soil containing 600 nCi/g transuranic and 30,000 nCi/g mixed fission products surrounded by uncontaminated soil. Radioactive isotopes present in the package were ^{241}Am, $^{238/239}Pu$, ^{137}Cs, ^{106}Ru, ^{90}Sr, and ^{60}Co. The ISV process melted the waste package and surrounding soil and immobilized the radionuclides in place, producing a durable, 8.6 metric ton glass and crystalline monolith. The test successfully demonstrated that the process provides containment of radioactive material. No release to the environment was detected during processing of cooldown. Due to the high temperature during processing, some gases were released into the off-gas hood that was over the test site. The hood was maintained at a slight negative pressure to contain any volatile or entrained material during processing. Gases passed from the hood to an off-gas treatment system where they were treated using a venturi-ejector scrubber, a tandem nozzle gas cleaner scrubber followed by a condenser, heater, and two stages of HEPA filters. The off-gas treatment system is located in the semi-trailer to allow transport of the process to other potential test sites. Retention of all radionuclides by the vitrified zone was greater than 99%. Soil-to-off-gas decontamination factors (DFs) for transuranic elements averaged greater than 4000 and for fission products, DFs ranged from 130 for ^{137}Cs to 3100 for ^{90}Sr. 7 references, 15 figures, 4 tables.

49557 **(PNL-SA—12522) Nuclear waste glass composition limitations.** Chick, L.A.; Swanson, J.L.; Goldman, D.S. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1984. Contract AC06-76RL01830. 19p. (CONF-840802—20). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000394.

From ANS International topical meeting on fuel reprocessing and waste management; Jackson Hole, WY, USA (26 Aug 1984).

This paper discusses the primary considerations involved in nuclear waste glass composition development, explains why the maximum content of certain elements in those glasses is limited, and suggests some possible improvements in reprocessing and waste management practices that might reduce vitrification costs. The basic task is to formulate a glass that can be processed with an acceptably high waste loading and the best possible chemical durabili-

ty. Problems encountered when certain elements are introduced at higher than acceptable levels include formation of crystalline sludges on the melter floor, increased off-gas system corrosion, and decreased product chemical durability. It is concluded that design decisions that result in reduced amounts of corrosion products and certain soluble neutron poisons, separations process chemicals, and waste handling chemicals in high-level waste (HLW) would, if feasible, reduce vitrification costs. 21 references, 6 figures, 2 tables.

49558 **(RHO-BW-CR—142-P) Nuclear waste repository in basalt: preliminary socioeconomic assessment.** Cluett, C.; Bolton, P.A.; Malhotra, S.; McStay, J.R.; Slingsby, J.A. (Battelle Human Affairs Research Center, Seattle, WA (USA)). Jun 1984. Contract AC06-77RL01030. 156p. (BHARC—400/83/023). NTIS, PC A08/MF A01; GPO Dep. File Number DE85000574.

This report was prepared as a part of the continuing site characterization activities for a proposed nuclear waste repository in basalt (NWRB) to be located on the Hanford Site near Richland, Washington. The purpose of this study is to assess the social and economic impacts that could be caused by the construction and operation of the proposed NWRB facility. The specific objectives of this study are to describe historical socioeconomic trends in the study area, to describe current conditions, to project future baseline conditions without the NWRB, to project potential impacts due to the proposed NWRB under two alternative regional development scenarios and assess their significance, and to suggest an overall impact management and mitigation strategy. A closely related objective is to assemble a comprehensive socioeconomic data base that can be easily updated for future analyses. This study examines employment, labor supply, population change, housing, local transportation, revenues, and expenditures for public services. This report documents the marked demographic and economic decline that has occurred in the study area since 1981 and concludes that future baseline growth will resume at a relatively slower pace after further expected declines have been experienced through about 1985. The projected socioeconomic impacts of the NWRB development are assessed under two alternative baseline scenarios and are not expected to be significant in either case. With careful planning and attention to impact mitigation, including public participation and interaction with local and regional planning agencies, potential socioeconomic impacts can be anticipated and managed effectively. Recommendations are made for providing frequent updating of the data base and for improving the analysis of socioeconomic impacts. 68 references, 19 figures, 38 tables.

49559 **(SAND—84-0343) Underground system for disposal of contact handled transuranic waste at the potential Yucca Mountain repository.** Stinebaugh, R.E. (Sandia National Labs., Albuquerque, NM (USA)). Sep 1984. Contract AC04-76DP00789. 39p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85001143.

This document describes the system of underground rooms and equipment for use in transporting, emplacing, and disposing of contact-handled transuranic waste at the potential Yucca Mountain repository. This information is provided to allow incorporation of these concepts into facility design. 1 reference, 17 figures, 2 tables.

49560 **(UCRL—53294-83) Spent fuel test - Climax: technical measurements. Interim report, Fiscal Year 1983.** Patrick, W.C.; Butkovich, T.R.; Carlson, R.C.; Durham, W.B.; Ganow, H.C.; Hage, G.L.; Majer, E.L.; Montan, D.N.; Nyholm, R.A.; Rector, N.L. (Lawrence Livermore National Lab., CA (USA)). Feb 1984. Contract W-7405-ENG-48. 95p. NTIS, PC A05/MF A01; GPO Dep. File Number DE84016775.

The Spent Fuel Test - Climax (SFT-C) is located 420 m below surface in the Climax stock granite on the Nevada Test Site. The test is being conducted as part of the Nevada Nuclear Waste Storage Investigations. Eleven canisters of spent nuclear reactor fuel were emplaced, and six electrical simulators were energized April-May 1980. The spent-fuel canisters were retrieved and the thermal sources were de-energized in March-April 1983 when test data indicated that test objectives were met during the 3-year storage phase. The SFT-C operational objective of demonstrating the feasibility of packaging, transporting, storing, and retrieving highly radioactive fuel assemblies in a safe and reliable manner has been met. In addition to emplacement and retrieval operations, three exchanges of spent-fuel between the SFT-C and a surface storage facility, conducted during the storage phase, furthered this demonstration. Technical objectives of the test led to development of a technical measurements program, which is the subject of this and three previous interim reports. Geotechnical, seismological, and test status data have been recorded on a continuing basis for the 3-1/2 year duration of the test on more than 900 channels. Data acquisition from the test is now limited to instrumentation calibration and evaluation activities. Data now available for analysis are presented here. Highlights of activities this year include a campaign of in situ stress measurements, mineralogical and petrological studies of pretest core samples, microfracture analyses of laboratory irradiated cores, improved calculations of near-field heat transfer and thermomechanical response during the final months of heating as well as during a six-month cool-down period, metallurgical analyses of selected test components, and further development of the data acquisition and data management systems. 27 references, 68 figures, 10 tables.

49561 **(USGS-OFR—84-450) Geohydrologic data for test well UE-25p No. 1, Yucca Mountain area, Nye County, Nevada.** Craig, R.W.; Johnson, K.A. (Geological Survey, Lakewood, CO (USA); Fenix and Scisson, Inc., Mercury, NV (USA)). 1984. Contract AI08-78ET44802. 70p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85001508.

The following data are given for test well UE-25p No. 1: drilling operations, lithology, availability of borehole geophysical logs, water levels, water chemistry, pumping tests, borehole-flow survey, and packer-injection tests. The well is one of a series of test wells drilled in and near Yucca Mountain adjacent to the Nevada Test Site, Nye County, Nevada, in cooperation with the US Department of Energy. These investigations are part of the Nevada Nuclear Waste Storage Investigations to identify suitable sites for underground storage of high-level radioactive wastes. Test well UE-25p No. 1 was drilled to a total depth of 1805 meters. To a depth of 1244 meters, the rocks are predominantly ashflow tuffs of Tertiary age. From 1244 to 1805 meters, the rock is dolomite of Paleozoic age. The composite static water level was approximately 381 meters below land surface for the Tertiary section and 361 meters for the Paleozoic section. Hydrologic tests were performed on the well during two different periods. The Tertiary section was tested after the well was drilled to 1301 meters, and the Paleozoic section was tested after completion of drilling. A pumping test of the Tertiary section showed a maximum drawdown of about 33.7 meters after pumping for 3150 minutes at 22 liters per second. Pumping of the Paleozoic section showed an apparent maximum drawdown of 9.3 meters after pumping for 6080 minutes at 31.5 liters per second. During the first 50 minutes of the pumping test, the discharge temperature increased from about 30 to 56°C. A borehole-flow survey showed that, for the Tertiary section of the hole, about 58% of the water withdrawn from the well came from the depth interval from 469 to 501 meters. For the Paleozoic section, 75% of the water withdrawn from the well came from the depth intervals from 1340 to 1362 meters and from 1515 to 1551 meters. 9 references, 49 figures, 6 tables.

49562 **Pioneering repository development at the Waste Isolation Pilot Plant.** Raudenbush, M.H. (Stoller (S.M.) Corp., Boulder, CO (USA)); Hohmann, G.L. (Westinghouse Electric Corp., Albuquerque, NM (USA). Waste Technology Service Div.). *Nuclear Engineering International;* **29**: No. 353, 31-33(Apr 1984).

The Waste Isolation Pilot Plant (Wipp) is authorized as an R and D facility to demonstrate the safe disposal of radioactive waste resulting from defense activities. The underground facility will be used for in-situ tests and demonstrations that address technical issues associated with the disposal of transuranic and defense high-level waste in bedded salt. The tests will investigate repository development, including thermal-structural interactions, plugging and sealing and facility operations; and waste package interactions, including the effects of the waste on local rock salt and the evaluation of waste package materials. Characterization and construction, institutional arrangements and the future of the Wipp project are discussed.

49563 **(CE-Trans—7930) Processing of highly radioactive nuclear waste.** Detilleux, E. Translated from *SRBE Bulletin ;* 98: No. 2, 129-136(1982). 18p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84901805. DE84901805

The following four questions dealing with highly active waste are answered: what is it and where does it come from. What are the processing techniques. What is the situation in Belgium.

0530 Environmental Aspects

REFER ALSO TO CITATION(S) 05300049507

49564 **(DOE/ID—12228) Incineration of hazardous and low-level radioactive waste by a small generator. Final report.** Dwight, C.C. (Arizona State Univ., Tempe (USA)). Oct 1984. Contract AC07-76ID01570. 230p. NTIS, PC A11/MF A01; 1; GPO Dep. File Number DE85001173.

The results from Arizona State University's study of the feasibility of a small generator incinerating low-level radioactive waste in a pathological incinerator are reported. The research included various aspects of environmental impact, public relations, cost versus benefit, and licensing procedures. Three years of work resulted in a license amendment authorizing the University to incinerate certain hazardous and low-level radioactive wastes. 13 references, 6 figures, 16 tables.

49565 **(KY/L—1328) Quantitative determination of uranium discharges in vent stack gases.** Beverly, C.R. (Paducah Gaseous Diffusion Plant, KY (USA)). 1984. Contract AC05-84OT21400. 8p. (CONF-841023—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85002073.

From 27. ORNL-DOE conference on analytical chemistry in energy technology; Knoxville, TN, USA (2 Oct 1984).

Trace level concentrations of UF_6 are present in vent gases exhausted to atmosphere through a tall stack. A metered gas sample is continuously withdrawn through a three-stage caustic bubbler charged with 0.25 N NaoH. Scrubber aliquots are acidified, spiked with ^{233}U and extracted with trioctylphosphine oxide to recover dissolved uranium. Uranium content and ^{235}U assay are determined simultaneously by isotope dilution mass spectrometry. 4 references, 5 tables.

0540 Health And Safety

REFER ALSO TO CITATION(S) 05400049440, 49541, 49564, 49897, 50363

49566 **(CONF-840307—49) Exposure and risk calculations for disposal of wastes having minimal radioactivity.** Fields, D.E. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000988.

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

The US Nuclear Regulatory Commission is currently considering revision of rules 10 CFR 20 and 10 CFR 61, which cover disposal of solid wastes containing minimal activity radioactivity. In support of these revised rules, we have evaluated the consequences of disposing of four waste streams at four types of disposal areas located in three different geographic regions. Consequences are expressed in terms of human exposures and associated health effects. Each geographic region has its own climate and geology. Example waste streams, waste disposal methods, and geographic regions chosen for this study are clearly specified. The PRESTO-II methodology was used to evaluate radionuclide transport and health effects. This methodology was developed to assess radiological impacts to a static local population for a 1000-year period following disposal. The modeling of pathways and processes of migration from the trench to exposed populations included the following considerations: groundwater transport, overland flow, erosion, surface water dilution, resuspension, atmospheric transport, deposition, inhalation, and ingestion of contaminated beef, milk, crops, and water. 9 references, 2 figures, 3 tables.

49567 **(DOE/OR/20722—15) Remedial action at the Acid/Pueblo Canyon site, Los Alamos, New Mexico. Final report.** (Bechtel National, Inc., Oak Ridge, TN (USA)). Oct 1984. Contract AC05-81OR20722. 43p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85000629.

The Acid/Pueblo Canyon site (TA-45) was designated in 1976 for remedial action under the Formerly Utilized Sites Remedial Action Program (FUSRAP). During the period 1943 to 1964 untreated and treated liquid wastes generated by nuclear weapons research activities at the Los Alamos Scientific Laboratory (LASL) were discharged into the two canyons. A survey of the site conducted by LASL in 1976 to 1977 identified two areas where radiological contamination exceeded criteria levels. The selected remedial action was based on extensive radiological characterization and comprehensive engineering assessments and comprised the excavation and disposal of 390 yd^3 of contaminated soil and rock. This document describes the background to the remedial action, the parties involved in administering and executing it, the chronology of the work, verification of the adequacy of the remedial action, and the cost incurred. 14 references, 5 figures, 5 tables.

49568 **(GJ/TMC—15) Feasibility of the use of nuclear-emulsion techniques in the study of drill core and water samples from the Monticello mill, Monticello, Utah.** Stieff, L.R. (Stieff Research and Development Co., Inc., Kensington, MD (USA)). Apr 1984. Contract AC07-76GJ01664. 122p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85002092.

This nuclear-emulsion feasibility study of the Monticello drill-core and water samples suggests that nuclear-emulsion techniques can provide a unique way of directly observing the modes of occurrence of and the relative mobility of some of the different alpha-active radionuclides in the uranium and thorium decay chains. The qualitative, descriptive information on the localization of these radionuclides, even though in this study the identification of the associated minerals could be only tentative at best, suggests that subsequent nuclear-emulsion studies combined with detailed mineralogic studies should be able to contribute in several important ways to the uranium-mill-tailings remedial-action program. For example, these contributions might include: Characterizing tailings piles not only on the basis of the bulk measurements of uranium, radium, radon, and other radionuclide concentrations, but also on the basis of the modes of occurrence of these radionuclides, their mineralogy, and their relative mobility. Proposing specific remedial action based on the modes of occurrence of Ra-226 and Th-230. Providing new techniques for assessing both the short-term and long-term effectiveness of certain remedial action. Procedures for minimizing the further movements of Ra-226 and Rn-222 within the tailings pile. Providing a new technique for detecting very low concentrations of Rn-222, Ra-226, Th-228, and certain other radionulcides in water samples. Providing a means of identifying those tailings piles which may present special health hazards because they contain numerous, intensely alpha-active, Ra-226-bearing particles in the colloidal to submicron size range. 38 references, 40 figures, 10 tables.

0550 Regulations

REFER ALSO TO CITATION(S) 05500049793

49569 **(Juel-Spez—216) Internal safeguards for centrifuge enrichment plants. Concepts and procedures for safeguards and the international Hexapartite Safeguards Project (HSP).** Mueller, R.; Steinebach, E.F.M.; Rezniczek, A.; Buttler, R.; Canty, M.J.; Lauppe, W.D.; Riciter, B.; Stein, G. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Programmgruppe Technik und Gesellschaft). Aug 1983. 176p. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number DE84751521.

These papers were elaborated partly as annexes to the HSP and partly within a BMFT research progbamme. Chapter 2 shows how the HSP is to be proceeded with and describes the inspection activities agreed upon. Chapters 3 and 4 deal with the nuclear materials accountancy in a uranium enrichment plant; the conception of a computer-aided safeguards system (chapter 4) can only be

given in condensed form owing to its size. Chapter 5 is a general evaluation of now available NDA and C/S systems whereas chapters 6 and 7 indicate fields of application for specialized technologies. Even though the inspection model agreed upon as a result of the HSP discussions is to include limited frequency unannounced access to separating rooms for inspectors, theoretical and experimental studies have been carried out in the meantime assuming the non-access model.

49570 **(Juel-Spez—230) Joint US-German evaluation of electronic safeguards seal systems.** Reuters, H.; Waddoups, I.G.; Richter, B.; Stein, G. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Programmgruppe Technik und Gesellschaft). Dec 1983. 26p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84751819.

49571 **(PNL-SA—12004) Safeguards and security design guidelines for conceptual monitored retrievable storage (MRS) facilities.** Byers, K.R.; Clark, R.G.; Harms, N.L.; Roberts, F.P. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1984. Contract AC06-76RL01830. 8p. (CONF-840734—23). NTIS, PC A02/MF A01; GPO Dep. File Number DE85000365.

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

Existing safeguards/security regulations and licensing requirements that may be applicable to an MRS facility are not currently well-defined. Protection requirements consistent with the NRC-graded safeguards approach are identified, as a baseline safeguards system with a comparison of the impacts on safeguards and security of salient features of the different storage concepts. In addition, MRS facility design features and operational considerations are proposed that would enhance facility protection and provide additional assurance that protection systems and procedures would be effectively implemented. 3 figures.

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

0702 Radiation Sources

49572 **(LA-UR—84-3028) Portable radiography using linear accelerators.** Reid, D.W. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 16p. (CONF-841117—6). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002045.

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

There are numerous instances where the availability of a portable high-energy radiography machine that could be transported to the inspection site with relative ease would save time, money, and make radiography of permanent installations, such as bridges, possible. One such machine, the Minac built by Schoenberg Radiation Inc., is commercially available. It operates at 9.3 GHz, has an electron energy on target of 3.5 MeV, and an output dose rate of 100 R/min. A second portable accelerator, recently completed at the Los Alamos National Laboratory, operates at 2.998 GHz, has electron energies on target of 6, 8, and 10 MeV, and an output dose rate of 800 R/min at 8 MeV. This paper discusses the need for and applications of portable accelerators for radiography. Physical characteristics and beam parameters of both machines are examined in detail. Problems of operating at higher frequencies to further minimize size and weight are discussed.

49573 **(OEFZS—4265) Wear measurements of cutting tools made of hard metal.** Frevert, E.; Franek, F.; Dworak, W.; Gruber, W.; Steinpichler, D.; Wezulek, R. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). Feb 1984. 31p. (In German). (IA—126/84). NTIS (US Sales Only), PC A03/MF A01. File Number DE84703145.

A method, suitable for industrial use, was tested for rapid and simple wear measurements of cutting tools made of hard metal. By irradiation with thermal neutrons to long lived radioactive isotopes ^{60}Co and ^{182}Ta were induced. The wear was determinated by collecting free of losses the drillings resulting from splintering off poles of aluminium, subsequent measurements of the integral gamma radiation and comparison with a standard probe. The detection mark of abrasion was about 15 ng. By this method not only the derivative trend of the wearing quality at the beginning of the process can be studied with respect to time, but also statements about the inhomogeneities of the splintered off material can be made. An analysis of the abrasion showed, that in the surface of the cutting tool the cobalt content was 3-4 times higher than in the normal composition.

08 HYDROGEN

0801 Production

REFER ALSO TO CITATION(S) 08010049332, 49655, 49656

49574 **(NP—4770518) Water electrolysis using hybrid cyclic processes.** Hunsaenger, K.H. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Maschinenwesen). 28 Jan 1983. 144p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE84770518.

The following hybrid processes for hydrogen production from the dissociation of water are presented: the sodium carbonate process, the sodium/lithium-nitrate-HCl process, the methane-methanol reduction process and the metal-metal hydride processes. The theoretical principles of the thermodynamic and process engineering concepts of hybrid cyclic processes are considered and the thermodynamic process efficiencies are analysed.

49575 **(PB—84-211747) Study of polymers and/or copolymers for use in the preparation of separators for the electrolysis of water: technology of the preparation of the separators. Final report.** Monnet, J. (Commission of the European Communities, Luxembourg). 1983. 128p. (In Italian). (EUR—8248-IT). NTIS, PC E07/MF E07.

Previous work on the production of hydrogen by high temperature alkaline water electrolysis, using asbestos separators reinforced with alkali resistant aromatic copolymers, i.e. either polystyrene-divinylbenzene or polyvinyl-pyridinedivinylbenzene, instead of plain asbestos, has been extended to testing polyphenylene sulphide (PPS) and sulphonated PPS as reinforcing agents.

49576 **Method for producing hydrogen and oxygen by use of algae.** Greenbaum, E. (to Dept. of Energy). US Patent 4,442,192. 10 Apr 1984. Filed date 16 Jun 1982. vp.

PAT-APPL-388872.

Efficiency of process for producing H_2 by subjecting algae in an aqueous phase to light irradiation is increased by culturing algae which has been bleached during a first period of irradiation in a culture medium in an aerobic atmosphere until it has regained color and then subjecting this algae to a second period of irradiation wherein hydrogen is produced at an enhanced rate.

49577 **Untangling the water gas shift from Fischer-Tropsch: A Gordian knot?.** Rofer-DePoorter, C.K. (Los Alamos National Lab., NM). pp 97-128 of Catalytic conversions of synthesis gas and alcohols to chemicals. Herman, R.G. New York, NY, USA; Plenum Press (1984). (CONF-830410—).

From 17. Middle Atlantic Regional meeting of the American Chemical Society; White Haven, PA, USA (6 Apr 1983).

This chapter demonstrates that the water gas shift shares a significant number of elementary reactions with the FischerTropsch synthesis, and probably with the Koelbel-Engelhardt synthesis, CO_2 methanation, and methanol synthesis. Studies of elementary reactions are emphasized in order to provide a basis for suggesting their participation in the water gas shift. Topics considered include the water gas shift reaction on metals, the water gas shift reaction on oxides, hydrogen adsorption, water adsorption, carbon monoxide adsorption, carbon dioxide adsorption, interactions among adsorbed species, overall reaction studies, the homogeneous water gas shift reaction, the comparison of mechanisms for different conditions, and methanol synthesis. While the water gas shift reaction commonly achieves equilibrium and can be represented by a conven-

tional balanced chemical reaction, the Fischer-Tropsch synthesis is at least partly controlled by kinetics and must be represented by a generalized chemical reaction. Oxygen transfer from CO_2 or H_2O to the catalyst and then to H_2 or CO may be the predominant route at higher temperatures in heterogeneous systems and appears to be possible for homogeneous systems.

09 OTHER SYNTHETIC AND NATURAL FUELS

REFER ALSO TO CITATION(S) 09000050316

0901 Hydrocarbon Fuels

REFER ALSO TO CITATION(S) 09012049577, 49588, 49590, 49591, 49959

49578 (DOE/CA/10004—T1) Biogas curriculum: workshop, April 6-11, 1981. Highnote, R. (Greenhills Foundation, Dallas, TX (USA)). 21 Dec 1981. Contract FG01-81CA10004. 135p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE84007310.

This report is a curriculum guide for those interested in biogas technology. Its purpose is to develop an understanding of the science, engineering, economics, and environmental implications of the biogas technology. The purpose of the training is to encourage application of biogas process design in the US on a small scale to utilize local supplies of indigenous alternate energy sources for production of fuel, feed and fertilizer with simultaneous pollution control.

49579 (NP—4770473) Use of novel catalysts founded on basic-fixed hydride-carbonyl complexed for the Fischer-Tropsch synthesis. Hemmerich, R. (Technische Hochschule Aachen (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 4 Jul 1983. 196p. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number DE84770473.

Within the framework of this thesis a novel method was used for fixing transition metal complexes on a carrier, and the properties of such heterogenized complexes are precursors for Fischer-Tropsch catalysts were investigated. The hydridic carbonyl complexes $HCO(CO)_4$, $HRuCo_3(CO)_{12}$ and $HFeCo_3(CO)_{12}$ react with amine-modified silica gels in an acid-base reaction to produce surface-bound ammonium salts without the deposition of by-products. By decarbonylation in a stream of hydrogen, a highly active metal carrier catalyst for Fischer-Tropsch synthesis is produced. X-ray diffraction and raster electron microscopic analysis revealed that the metal is present in highly dispersed, amorphous, form on the carrier surface. All catalyst systems have in common the pronounced tendency to form methane and straight-chained hydrocarbons with high proportions of olefins.

49580 (PB—84-214790) Biomethanization plant in Bailonville. Lemal, B.; Binet, B. (Commission of the European Communities, Luxembourg). 1983. 43p. (EUR—8547-EN/FR). NTIS, PC E03/MF E03.

Illustrations in French.

The subject of this report is the biomethanization installation situated on a small poultry farm near Marche (Belgium). The poultry manure occupies the lower half of the cylinder and the biogas produced by anaerobic biological digestion is stored in the upper part. The report describes the performance of this installation over a period of 20 months, during which the digester produced approximately 230 gigajoules in the form of biogas. The global energy yield of the installation is greater than 60%. If the authors deduct from the overall cost of the project those amounts connected with the prototype character of the installation, break-even point can be achieved for this type of small digester, which is not only a significant source of energy, but also has the advantage of producing a deodorized organic fertilizer.

49581 Size distribution of airborne particulate matter emitted by the front-end processing of municipal solid waste feed material for large-scale anaerobic digesters. Gerrish, H.P.; Narasimhan, R.; Daly, E.L. Jr.; Sengupta, S.; Nemerow, N.L.; Wong, K.V. (Univ. of Miami, Coral Gables, FL). *Journal of the Air Pollution Control Association;* **34**: No. 7, 779-782(Jul 1984). Contract AS05-78EV10133.

A 100-ton/day proof-of-concept facility has been constructed in Pompano Beach, Florida, to examine the feasibility of producing methane-rich gas from the anaerobic digestion of municipal solid waste. One of the possible environmental impacts is from the particulate matter emitted into the atmosphere by the secondary shredding and conveying of light fraction feed material to the digesters. It has been found that the amount of particulate matter emitted into the atmosphere by the front-end processing is an order of magnitude higher when the plant is operating compared to when it is not operating. It has been found that the particle size distribution is bimodal both when the plant is operating as well as when it is not operating. Particle concentrations of episodic nature were found in July 1981 which were four times the concentration found during normal plant operation.

49582 Metal-zeolite catalysts for the conversion of synthesis gas to selected hydrocarbon products. Rao, V.U.S.; Chi, R.D.H.; Gormley, R.J.; Pantages, G.; Rhee, K.H.; Schehl, R.R. (U.S. Dept. of Energy, Pittsburgh Energy Technology Center). pp 151-165 of Catalytic conversions of synthesis gas and alcohols to chemicals. Herman, R.G. New York, NY, USA; Plenum Press (1984). (CONF-830410—).

From 17. Middle Atlantic Regional meeting of the American Chemical Society; White Haven, PA, USA (6 Apr 1983).

This chapter examines the behavior of cobalt-ZSM-5 catalysts in the conversion of synthesis gas. The catalysts prepared by solution impregnation methods are investigated, and it is shown that the method could result in partial ion exchange of the acidic protons in ZSM-5 by cobalt ions. The catalysts are characterized using infrared spectroscopy to examine the acid sites prior to and after the addition of the metal component to the zeolite. Topics considered include preparation of catalysts, synthesis gas conversion tests, ethylene conversion tests, the catalytic conversion of synthesis gas, the catalytic conversion of ethylene, and catalyst characterization. The experiments show important differences in selectivity depending on the method of preparing Co-ZSM-5 catalyst for synthesis gas conversion.

49583 Economic optimization of anaerobic fermenter designs for beef production units. Hashimoto, A.G.; Chen, Y.R. (Meat Animal Research Center, Clay Center, NE). pp 129-132 of Livestock waste: a renewable resource. St. Joseph, MI, USA; American Society of Agricultural Engineers (1981). (CONF-8004241—).

From 4. international symposium on livestock wastes; Amarillo, TX, USA (15 Apr 1980).

It is apparent from reports that producing methane (CH_4) from livestock manures is technically feasible and, in some instances, economically feasible. It is known that the maximum amount of CH_4 per unit weight of substrate is achieved at long retention times; however, long retention times dictate very large fermenter volumes and high capital costs. This paper presents an approach to optimize fermenter designs based on maximizing the net energy production per unit fermenter cost. 12 references, 4 figures, 4 tables.

0902 Alcohol Fuels

REFER ALSO TO CITATION(S) 09020049600

49584 (NP—4901773) Alcohol fuel from Ohio farms. (Jones (John David) and Associates, Inc., Cuyahoga Falls, OH (USA)). 1980. 34p. Dept. of Development, Div. of Energy, Box 1001, Columbus, OH 43216. File Number TI84901773.

Brief descriptions of on-farm ethanol production methods including feedstock preparation, cooking, fermentation, and distillation are presented. Safety conditions are described. Investment in

on-farm ethanol production facilities and their potential returns are addressed. The market for ethanol and ethanol blends as well as for by-products is encouraging. Legal aspects for permitting and environmental regulations both for Ohio and federal agencies are discussed. (DMC)

49585 **(PB—84-215789) Testing and evaluation of on-farm alcohol production facilities. Final report.** Kuby, W.; Markoja, R.; Nackord, S. (Acurex Corp., Mountain View, CA (USA). Energy and Environmental Div.). Jul 1984. 100p. (FR—80-69/EE). NTIS, PC A05/MF A01.

Ethanol is the most important of biomass derived fuels in the short term. The bulk of the production will come from large (20 to 600M gallons/year) units with the remainder being produced on-farm in small (less than 6,000 gallons/year) units. The on-farm production of alcohol presents a unique problem in that the Environmental Protection Agency (EPA) had no data available by which it could evaluate the possible impacts of a very large number of these facilities. This report gives the results of a sampling and analysis program conducted to characterize the air emissions, water effluents, and solid residuals from two on-farm ethanol production processes sampled in June 1980. Several recommendations, including acid neutralization and effluent ponding, are recommended to minimize the impacts.

49586 **(PNL-SA—12270) Catalysts for gasification of biomass.** Brown, M.D.; Mudge, L.K.; Baker, E.G. (Pacific Northwest Lab., Richland, WA (USA)). 1984. Contract AC06-76RL01830. 19p. (CONF-840509—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85000371.

From 6. symposium on biotechnology for fuels and chemicals; Gatlinburg, TN, USA (1 May 1984).

The purpose of the project is to evaluate the technical and economic feasibility of generating specific gas products by catalytic gasification of biomass. Catalysts are widely used commercially to produce specific products from a variety of feedstocks. Application of catalysts for generation of valuable products from wood is an attractive possibility because of wood's favorable properties, namely a high volatiles content, low ash and low sulfur content. Direct processing of wood with many commercial catalysts is, therefore, potentially possible without severe catalyst poisoning. Commercial and prepared catalysts were found to be active for generation of synthesis gases from wood by steam gasification. A prepared catalyst, Ni-Co-Mo on silica-alumina doped with 2 wt % Na, retained activity indefinitely for generation of a methanol synthesis gas from wood at 750°C (1380°F) and 100 kPa (1 atm) absolute pressure. Results are presented for a variety of commercial and prepared catalysts used to enhance steam gasification of wood. Current studies are designed to develop process systems to realize the potential of catalyzed gasification of biomass. Systems that avoid catalyst deactivation by attrition and carbon deposition are being tested in bench scale equipment. Status of the development studies is presented. 6 references, 3 figures, 6 tables.

49587 **(PNL-SA—12456) Gasification of biomass for the production of methanol and ammonia.** Baker, E.G.; Mudge, L.K.; Brown, M.D. (Pacific Northwest Lab., Richland, WA (USA)). May 1984. Contract AC06-76RL01830. 14p. (CONF-840828—5). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000372.

From International synfuels policies and technologies symposium; Philadelphia, PA, USA (19 Aug 1984).

Pacific Northwest Laboratory is developing a process for conversion of biomass to specific gas products. Biomass is reacted with steam or steam/air at high temperatures in the presence of catalysts. Specific gases that have been produced include methanol synthesis gas and ammonia synthesis gas. Gasification tests have been conducted in a laboratory-scale gasifier and in a 1-ton/day fluidized-bed process development unit. Maintaining catalyst activity in the fluidized-bed gasifier is the major remaining technical hurdle. 10 references, 2 figures, 4 tables.

0903 Inorganic Hydrogen Compound Fuels

REFER ALSO TO CITATION(S) 09032049587, 50306

49588 **Economic feasibility of cattle manure as a chemical feedstock.** Beck, S.R. (Texas Tech Univ., Lubbock). pp 314-316 of Livestock waste: a renewable resource. St. Joseph, MI, USA; American Society of Agricultural Engineers (1981). (CONF-8004241—).

From 4. international symposium on livestock wastes; Amarillo, TX, USA (15 Apr 1980).

Bench-scale studies were undertaken to study the gasification of cattle manure to an ammonia synthesis gas. The process which resulted was entitled the Synthesis Gas From Manure (SGFM) process, but has since been used on other biomass feedstocks. A pilot plant was constructed to test the SGFM process in a continuous mode of operation. DOE supported development of a data base to be used for designing a commercial gasification facility, evaluation of other biomass feedstocks, and an economic evaluation of SGFM technology in the production of ammonia synthesis gas. This paper describes the SGFM process and the results of pilot plant manure gasification, and gives an economic evaluation of ammonia production.

0904 Solid Waste And Wood Fuels

49589 **(DOE/CE/30760—T1) Oxidation of volatiles in residential wood burning equipment. Final technical report, September 1980-February 1984.** Malte, P.C.; Thornton, M.M.; Kamber, P.D. (Washington Univ., Seattle (USA)). Apr 1984. Contract FG02-80CE30760. 122p. NTIS, PC A06/MF A01; GPO Dep. File Number DE84017325.

The objectives of this project are to measure, through the use of laboratory combustors, those conditions which promote complete combustion of wood volatiles in residential wood burning equipment. The conditions of interest are combustion temperature, residence time, stoichiometry, and air mixing. The project objectives are met through two laboratory approaches: (1) model compound studies: in order to measure the overall rates of oxidative pyrolysis of biomass volatiles, and to determine the types of intermediate organic species which are likely to form as part of this process, model compounds have been reacted in a specialized jet-stirred reactor, which has been developed as part of this research. (2) high-intensity wood combustion: in order to study the clean combustion of wood, that is, to investigate the conceptual design features required for clean burning, and to ascertain the levels and types of pollutant and condensible species which are most difficult to oxidize, a high-intensity, research wood combustor has been developed and examined for the different phases of the wood burning cycle. Although the objectives of the project have been met, it has not been possible, because of support limitations, to thoroughly explore several interesting aspects which have arisen because of this research. For example, a third laboratory system in which wood pyrolysis gas is injected directly into the a well characterized reactor, so that the kinetics and mechanisms of the gas-phase reaction of the actual biomass volatiles can be studied, could not be thoroughly developed. Refinements in the high-intensity wood combustor, which would bring its design features closer to practicality for the industry, could not be considered. 32 references, 37 figures, 10 tables.

49590 **(EPRI-AP—3678) Proceedings: EPRI/TVA biomass workshop on the use of biomass for the generation of electric power.** (Battelle Columbus Labs., OH (USA)). Sep 1984. 243p. (CONF-8303174—). Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920041.

From EPRI/TVA workshop on the use of biomass for the generation of electric power; Palo Alto, CA, USA (2 Mar 1983).

On March 2 and 3, 1983, EPRI and TVA sponsored a workshop, which was held at Palo Alto, to discuss R and D needs associated with the use of biomass fuels for power generation. The broad objective was to provide a basis for the planning of EPRI activities in this area. The Proceedings are a compilation of papers presented at the Workshop. In addition, the results of a ranking exercise concerning Research and Development Opportunities in bio-

mass are presented. The rankings were obtained by means of a questionnaire that was completed not only by attendees at the Workshop but also a few nonattendees who represented significant points of view. Separate abstracts have been prepared for each paper for inclusion in the Energy Data Base.

49591 **(PB—84-211663) Evaluation of energy from the biomass of agricultural origin: a review of the achievements in France and Italy. Series fast No. 15.** Farget, M.A. (Commission of the European Communities, Luxembourg). 1983. 124p. (In French). (EUR—8666-FR). NTIS, PC E06/MF E06.

Many schemes to produce energy from biological sources have been set up recently in France and Italy. They are reviewed in the present report. The experimental systems include the use of straw, wood and vegetable waste in domestic heating and the drying of agricultural crops. The gasification, and aerobic and anaerobic fermentation of vegetable matter are considered. Terrestrial and aquatic crops developed specifically for energy production are discussed. A better understanding of the materials used would be advantageous, and research and development into efficient conversion systems must take place. The main problem in initiating such schemes on a large scale is the lack of information on financial and technical aid.

13 HYDRO ENERGY

49592 **(EGG—2330) DOE Small-Scale Hydropower Program annual status report 1984.** Rinehart, B.N.; Chappell, J.R.; Sommers, G.L. (eds.). (EG and G Idaho, Inc., Idaho Falls (USA)). Sep 1984. Contract AC07-76ID01570. 49p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85001445.

This report summarizes the research and development activities of the Department of Energy's (DOE's) Small-Scale Hydropower Program for fiscal year 1984, and provides an annotated bibliography of research, engineering, operations, regulations, and costs of projects pertinent to hydropower development. The Small-Scale Hydropower Program is reported in five sections: Engineering Development Projects, Technology Development Projects, Technology Transfer Projects, Environmental Research, and Legal and Institutional Aspects. The bibliography discusses reports written by both private and nonfederal-government sectors.

1301 Resources And Availability

49593 **(DOE/NBM—5000722) Water resources appraisal for hydroelectric licensing: Middle San Joaquin Valley basin, Fresno, Madera, Mariposa, and Merced Counties, California.** (USDOE Federal Energy Regulatory Commission, Washington, DC. Office of Hydropower Licensing). Sep 1984. 140p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE85000722.

The basin and prior reports and current investigations are described. Also included are: the economy of the area, existing water and related land resources development, potential hydropower development, economic and human needs for further development of water and related land resources, and plans for future development. (MHR)

49594 **(DOE/NBM—5001730) Water resources appraisal for hydroelectric licensing: Middle San Joaquin Valley basin, Fresno, Madera, Mariposa, and Merced Counties, California.** (USDOE Federal Energy Regulatory Commission, Washington, DC. Office of Hydropower Licensing). Sep 1984. 140p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE85001730.

The basin is described and an annotated listing of prior reports is presented. The following are discussed: the economy of the area, existing water and related land resources development, potential hydropower development, economic and human needs for further development of water and related land resources, and plans for future development. 44 references, 70 figures, 26 tables. (MHR)

1302 Site Geology And Meteorology

49595 **(DOE/R4/10233—T1) Low head, micro-hydro demonstration project, Coker, Alabama. Final report.** Simpson, B.J. (Simpson (B.J.), Coker, AL (USA)). Sep 1983. Contract FG44-80R410233. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000223.

Project objective was to demonstrate the feasibility of using a crossflow (Banki) turbine in a low head, run-of-steam application. Project consisted of construction of small dam across Big Creek at Coker, Alabama. Design, construction and installation of a crossflow turbine with appurtenant feed water structures and control devices. Design of crossflow turbine was for 6 ft net head at 15 cubic ft per second flow. Dimensions of turbine constructed were: diameter 19", length 72", No. of blades - 20. Jet thickness (nozzle opening) 1.25" with calculated full flow rpm of 117. Construction was started in summer of 1981 and completed in September 1981. Before any meaningful information could be gained the dam was demolished by flood. The dam was rebuilt during the summer of 1982. Preliminary testing, using a 8 kW Dayton ac Generator with gear box (input rpm 540) indicated a peak power output at full flow of 2.8 kW as opposed to calculated 7 kW at 75% efficiency for the system. This testing was done in November and December of 1982 under extremely difficult conditions which included destruction of the turbine blades by debris pushed into high backwater. Due to frequent and heavy rains during the winter of 1983 no testing was possible in January and February. In March 1983 the dam was lost again due to severe flooding conditions eroding away the end of the dam. The project will be rebuilt at some future time when funds become available.

49596 **(NP—4751639) Glacial-hydrological conditions in Nordbosoe basin, Johan Dahl Land.** Clement, P. (Groenlands Geologiske Undersoegelse, Copenhagen (Denmark)). Dec 1983. 57p. (In Danish). NTIS (US Sales Only), PC A04/MF A01. File Number DE84751639.

This report treats the glacier-hydrological situation inside the Nordbosoe basin, Johan Dahl Land, South Greenland, as a basis for mapping hydropower potential. The main water source is Nordbogletscher, an outlet from the Inland Ice. The glacier has been advancing since the beginning of the last century and terminates in the proposed reservoir, 660 m above sea level. From knowledge of the height-area distribution, and the measured ablation in the different elevation bands, the total amount of ablation from the hydrological area of the glacier is calculated. The ablation is to a high degree dependent upon temperature. From temperature measurement in Narssarssuaq the yearly ablation from Nordbogletscher is calculated for the period 1962-1983. Because of delineation problems on the Inland Ice, totals of the mass balance of Nordbogletscher cannot be given. However, mass balances have been measured on the nearby Valhaltindegletscher, which is thought to be representative for the whole area. Calculations of mass balance during the period 1962-1983 show in general negative values, which means that the runoff from the Nordbosoe basin in this period was geater than it would have been for a non-glacierized basin. The condition of drainage of the most important ice-dammed lakes in Johan Dahl Land have been investigated with special attention to the runoff contribution of Base Camp lake inside the Nordbosoe basin. The report concludes that development of hydropower from the Nordbosoe basin is practicle from a hydrological point of wiew, but that fundamental investigations concerning glacier dynamics are still needed before a final evaluation can be given.

1304 Regulations And Licensing

REFER ALSO TO CITATION(S) 13040049597, 49599

1305 Economics And Management

49597 **(GAO/RCED—84-116) Information on relicensing cases at the Federal Energy Regulatory Commission.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 15 May 1984. 7p. US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760. File Number TI84901516.

One objective of our review was to obtain information concerning whether the public benefits when competing applications are filed for the existing nonfederal hydroelectric facilites. To do this we reviewed the applications and correspondence on file at the Commission for the nine contested cases involving municipalities (listed in enclosure I) to see if the private utilities had filed amended applications containing more actions after their relicense applications had been contested. The second objective was to obtain information on uncontested applications and relicenses to see if the Commission had issued the relicense contingent upon further actions being taken by the applicants. We selected 10 uncontested cases (listed in enclosure II) from the universe of 116 cases. The 10 selected were chosen to provide a broad geographic coverage and to reflect different project sizes. We selected five cases where the Commission had issued the licenses and five cases that are pending. In the five issued cases, we reviewed the license to see if the Commission had ordered additional actions. In the five pending cases, we reviewed the proceedings to see if the Commission had requested additional actions.

49598 **(GAO/RCED—84-143) Tennessee Valley Authority's benefits and cost for rehabilitating the Ocoee No. 2 hydroelectric project.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 23 Jul 1984. 37p. General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760. File Number TI85900087.

Report to The Honorable Don Sundquist, House of Representatives.

The Tennessee Valley Authority's (TVA's) No. 2 hydroelectric project on the Ocoee River in Tennessee was originally constructed in 1913. In 1976 TVA took it out of service because of deterioration of trestles used to support the 4.6-mile wooden flume which transported water between the dam and powerhouse. In 1979 TVA decided to rehabilitate the trestles and flume to restore generation of electricity. Since the powerplant was shut down in 1976, water has been released through the dam into the natural riverbed. This created conditions along this stretch of the river favorable to recreational whitewater rafting which were projected to attract an estimated 100,000 visitors in 1983. TVA's decision in 1979 to rehabilitate the project created controversy between recreational users and TVA. This report provides information on TVA's efforts to identify the benefits that were expected to accrue from the rehabilitation project, the total costs incurred for rehabilitation, the cost of power generated from Ocoee, the estimated number of recreational visits for 1983, the estimated total revenues or dollar value of those visits, and an agreement resolving the recreational controversy.

49599 **(ORNL/TM—9165) Allocation and apportionment of joint-use cost to power: a report on the assessment of headwater benefits charges.** Perlack, R.D.; Turhollow, A.F. Jr.; Johnson, D.L. (Oak Ridge National Lab., TN (USA)). Oct 1984. Contract AC05-84OR21400. 62p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85001733.

The Code of Federal Regulations under the Federal Power Act requires the Federal Energy Regulatory Commission (FERC) to assess annual charges against owners of downstream hydropower plants that are directly benefitted by an upstream federal reservoir or headwater improvement. Such benefits have been defined by FERC as annual gains in energy generated above the energy that could have been produced by the natural or unregulated streamflow. The charges assessed to the downstream beneficiaries are for an equitable portion of the costs of providing the joint-use facilities at the headwater improvement (e.g., dam and reservoir). The charges apportioned to each downstream beneficiary are based in direct proportion to the headwater benefits received. This report provides an overview of the FERC headwater benefits investigation process through discussion of the methods used to allocate and apportion joint-use costs among beneficiaries.

1307 Power Conversion Systems

REFER ALSO TO CITATION(S) 13070049595

14 SOLAR ENERGY

REFER ALSO TO CITATION(S) 14000049959

49600 (CONF-830179—Vol.2, pp 26p, Paper 5) **What alternate supply options (besides coal) are proving practical.** Massicot, P. (Maryland Energy Administration, Annapolis). 1983. D. File Number TI84901918.

From Energy: challenges and opportunities for the Middle Atlantic United States symposium; Baltimore, MD, USA (10 Jan 1983).

A number of alternative supply options are now practical. Those which have the potential for contributing to our energy supply, depending on their ultimate success in the marketplace, include passive solar, solar hot water heating, wood energy, combustion of municipal solid waste, groundwater heat pumps, and ethanol fuels. Options which are technically feasible but which appear to have limited applicability, due to high system cost, include solar space heating, photovoltaics and small wind energy systems. The potential for a significant breakthrough in photovoltaics costs appears promising. Landfill gas and small-scale hydropower are practical, but feasible sites are limited. Several technologies, including high-temperature solar, large wind energy systems, geothermal, and ocean thermal, require continued investment in development in order to bring them to a point where conclusions about feasibility can be finalized. Methanol fuel is not practical, but this is not due to fundamental technical or economic barriers but to the lack of a method to stimulate market development.

1401 Resources And Availability

REFER ALSO TO CITATION(S) 14010050019, 50020, 50021, 50022

49601 **(DOE/BP—287) Solar access protection: executive summaries of the 1981-1982 Bonneville Power financial assistance grants to local governments.** (Allen (Eliot) and Associates, Inc., Salem, OR (USA)). Dec 1983. Contract AC79-79BP13222. 46p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84017144.

This booklet contains executive summaries of selected community energy planning projects which were carried out by local governments in the Pacific Northwest with financial assistance from the Bonneville Power Administration (BPA). BPA provided this assistance through a competitive grant program which began in 1981, and which has provided two subsequent rounds of annual grants to local governments. This program has funded planning efforts which lead to electrical conservation and renewable resource development, and has encouraged local government participation in developing solutions to the region's electric energy needs. The program goals included establishment of positive relationships between local governments and utilities; development and adoption of plans and ordinances that lead to electrical conservation; and testing of community energy management programs.

1403 Economics

49602 (DOE/ET/20356—15) Effects of expiration of the federal energy tax credit on the National Photovoltaics Program. (Jet Propulsion Lab., Pasadena, CA (USA)). May 1984. Contract AI01-76ET20356. 47p. (JPL-PUB—84-36). NTIS, PC A03/MF A01; GPO Dep. File Number DE85000329.

The federal energy tax credit is scheduled to expire at the end of 1985. This study concludes that the US photovoltaic (PV) manufacturing industry will be hurt by the expiration. Projected 1986 sales are significantly reduced as a direct result of system price increases following from expiration of the credits. The character of the industry will probably change, with greatly reduced emphasis on domestic electric utility applications. Indirect effects arising from unrealized economies of scale and reduced private investment in PV research and development (R and D) and in production facilities could have a very large cumulative adverse impact on the US PV industry. The industry is forecasting as much as a fourfold reduction in 1990 sales if tax credits expire, compared with what sales would be with the credits. Because the National Photovoltaics Program is explicitly structured as a government-industry partnership, large changes in the motivation of funding of either partner can affect program success profoundly. In particular, reduced industry participation implies that such industry tasks as industrialization and new-product development will be slowed or even halted. In addition, those PV research areas receiving heavy R and D support from private PV manufacturers, such as collector research, module reliability, and some balance-of-system development and large-system experiments, will be adversely affected due to reduced private participation and funding. Finally, the curtailment of electric utility applications will delay realization of photovoltaics as an important US bulk power option.

1404 Environmental, Legal, And Institutional Aspects

REFER ALSO TO CITATION(S) 14040049601, 49602

49603 (DOE/CH/00178—T23) Assuring consumer information and protection in the solar market: need, status, strategy. (Consumer Energy Council of America, Washington, DC). Oct 1981. Contract AC02-77CH00178. 109p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85001305.

In this report the Consumer Energy Council has examined a number of basic issues affecting consumer assurance in the solar market. A general framework has been established to specify the role of consumer assurance as it relates both to government activity and a new consumer product industry. The available empirical evidence has been reviewed to identify the actual needs for consumer assurance in the solar market. By synthesizing the work of the SOLCAN Planning Project participants we have identified both the general thrust of existing consumer assurance mechanisms in the states and the direction that efforts to improve and expand those mechanisms are likely to take. Finally, several brief recommendations for combining the pieces of consumer assurance into an effective overall framework have been put forward.

49604 (EPRI-AP—3665-SR) Electric utility solar energy activities: 1983 survey. Mark, K. (Electric Power Research Inst., Palo Alto, CA (USA)). Sep 1984. 274p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920040.

This report presents the results of a survey to determine the scope of electric utility participation in solar energy projects in the United States. This ninth edition contains brief descriptions of 870 projects conducted by 184 utility companies. The report also includes an index of projects by category, a statistical summary, a list of new reports on utility-sponsored projects, a list of participating utilities organized by state, and a listing of these utilities with information contacts and addresses.

1405 Solar Energy Conversion

REFER ALSO TO CITATION(S) 14050049578, 49580, 49583, 49584, 49586, 49587, 49588, 49591, 50187, 50337, 50420

49605 (CONF-8310316—1) Forest nutrient cycles as affected by climate, species composition, stand age, and intensive harvesting. Johnson, D.W. (Oak Ridge National Lab., TN (USA)). 1983. Contract AC05-84OR21400. 31p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85000968.

From International Energy Agency meeting on biomass growth and production; Seattle, WA, USA (17 Oct 1983).

Patterns of nutrient cycling and distribution vary systematically with respect to climate, species, and stand age. Forest floor mass and nutrient content increase with stand age up to a maximum value which is determined by litterfall and decomposition rate. Litterfall and decomposition increase from cool to warm climates, but maximum forest floor weight decreases in warm climates because decomposition rates increase more rapidly than litterfall with increasing temperature. Thus, the age at which the forest floor reaches a steady state decreases from cooler to warmer climates. Maximum forest floor mass and the age at which it is reached are generally lower in deciduous forests than in coniferous forests. Deciduous forests take up, recycle, and accumulate greater amounts of nutrients per unit biomass produced than coniferous species do, but exceptions to this rule are noted. Intensive, short-rotation harvesting will cause large changes in nutrient distribution and fluxes, especially in cooler climates. Shortening rotations will accelerate nutrient outputs (both by biomass removal and leaching) and may require increased inputs (fertilization) while simultaneously reducing the maximum accumulation of nutrients in tree biomass and forest floor. Prevention of large forest floor accumulations is an especially significant change for cool, coniferous forests but is less so for warm and/or deciduous forests where forest floors naturally reach steady state early in stand development. 36 references, 5 figures.

49606 (DOE/ER—0147/2) Annual report and summaries of FY 1984 activities supported by the Division of Biological Energy Research. (USDOE Office of Energy Research, Washington, DC. Biological Energy Research Div.). Oct 1984. 67p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85002121.

The Division of Biological Energy Research (BER) program fulfills the need in the Department of Energy for a fundamental biological research activity designed to generate the information essential to development of biosystems related to energy matters. The research areas are primarily in the bioconversion realm with primary emphasis on basic mechanistic studies. Most notable of these are: (1) basic studies on methanogenesis, including the physiology, genetics and biochemistry of methanogens and of organisms that tie into the anaerobic digestion processes; (2) mechanisms of microbial breakdown of cellulose and other members of the lignocellulosic complex; (3) the plant cell wall, its structure and function; and (4) the biochemical changes associated with the responses of plants and microorganisms to physical stresses, temperature, moisture, pH and salinity. Other major areas of emphasis in the botanical and microbiological areas include: (1) photosynthesis, the primary conversion of solar to chemical energy as carried on by greenplants and bacteria; (2) the regulatory processes in growth and development of plants that determine ultimate productivity; (3) the metabolic regulatory mechanisms in plants that determine how the photosynthetic assimilated resources are utilized; (4) bioconversions by microorganisms involving fermentation mechanisms; (5) anaerobic and/or thermophilic microbial conversion mechanisms leading to materials useful as fuels or industrial chemicals; (6) the genetic and cellular processes that will serve as the foundation for genetic manipulation of plants and microorganisms in the future; and (7) the basis of organismal interactions in symbiosis, host-pathogen and other interrelations with emphasis on recognition as well as information and metabolic transfer mechanisms. (ACR)

49607 **(DOE/JPL—1012-94) Progress report 22, January-September 1983 and proceedings of the 22nd Project Integration meeting.** (Jet Propulsion Lab., Pasadena, CA (USA)). 1983. Contract AI01-76ET20356. 629p. (JPL-PUB—84-2; CONF-8309276—Summ.). NTIS, PC A99/MF A01; 1; GPO Dep. File Number DE85000334.

From 22. project integration meeting; Pasadena, CA, USA (28 Sep 1983).

This report describes progress made by the Flat-Plate Solar Array Project during the period January to September 1983. It includes reports on silicon sheet growth and characterization, module technology, silicon material, cell processing and high-efficiency cells, environmental isolation, engineering sciences, module performance and failure analysis and project analysis and integration. It includes a report on, and copies of visual presentations made at the 22nd Project Integration Meeting held at Pasadena, California, on September 28 and 29, 1983.

49608 **(DOE/JPL/955392—3) Safety requirements for wiring systems and connectors for photovoltaic systems. Final report.** Lundtveit, T. (Underwriters Labs., Inc., Northbrook, IL (USA)). Sep 1984. Contract NAS-7-100-955392. 87p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85001360.

Safety requirements for wiring systems and connections and for separable connectors for use in roof-mounted photovoltaic (PV) arrays are identified. These requirements were established by considering the environmental use-conditions applicable to PV arrays and the differences between integral-, direct-, standoff- and rack-mounted modules. The articles in the National Electrical Code (NEC) covering wiring systems are discussed to: (1) define the wiring systems, (2) identify the permitted uses and use-restrictions, (3) outline the advantages and disadvantages and (4) address the concerns regarding support, protection against mechanical damage and wet versus dry locations. An overall assessment is made of the advantages and disadvantages of each wiring system to arrive at candidate wiring systems that are best suited for use in PV arrays. For candidate wiring systems having use-restrictions that may prohibit their use, considerations are given that need to be addressed by any proposed revision to the National Electrical Code to permit acceptance by the inspection authorities. The various wiring termination methods that are permitted by the NEC are discussed and those which have features that are desirable for PV applications are identified. Performance and construction requirements for PV cable and for PV connectors are presented in separate outlines of proposed investigations of these products.

49609 **(DOE/JPL/956615—84/3) Laser-assisted solar cell metallization processing. Quarterly report, March 13-June 12, 1984.** Dutta, S.; McMullin, P.G. (Westinghouse Research and Development Center, Pittsburgh, PA (USA)). 20 Aug 1984. Contract NAS-7-100-956615. 41p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85001706.

Laser-assisted processing techniques, utilized to produce fine, metal grid patterns for high-efficiency solar cells, are being investigated, developed, and characterized. The work performed in the third quarter of this contract is detailed here. A preliminary economic evaluation has yielded the conclusion that laser-assisted pyrolysis of spun-on silver neodecanoate is the most promising of all the metallization techniques being investigated in this contract. Early adhesion problems have been solved by optimizing deposition parameters. Linewidth studies have been carried out as a function of laser power, scan speed, and film thickness. Preliminary solar cells have been fabricated and characterized using this metallization scheme. Silver neodecanoate films have also been decomposed using a pulsed uv laser and metal mask. A detailed study of the various models of localized surface temperature rise in silicon due to laser heating has been carried out. A review of this study and calculations of the silicon temperature rise resulting in decomposition of the spun-on silver neodecanoate are presented here.

49610 **(DOE/JPL/956786—84/1) Development of high-efficiency solar cells on silicon web. First quarterly progress report, April 20-July 15, 1984.** Rohatgi, A.; Meier, D.L.; Campbell, R.B.; Rai-Choudhury, P. (Westinghouse Research and Development Center, Pittsburgh, PA (USA)). 9 Aug 1984. Contract NAS-7-100-956786. 23p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001383.

The major objective of the work reported is to improve web base material with a goal toward obtaining solar cell efficiencies in excess of 18% (AM1). The program consists of the investigation of carrier loss mechanisms in web silicon, development of techniques to reduce carrier recombination in web, and web cell fabrication using effective surface passivation. Web surfaces have been bevelled with the intention of measuring the electrical activity of the twin plane. Web crystals have been intentionally contaminated with vanadium and titanium to examine the twin-plane-assisted internal gettering by DLTS. Model calculations were done to see the effect of twin-plane activity on V/sub oc/ as a function of resistivity of the web material. Experiments were initiated to study the effect of heat treatment and gettering on the minority carrier diffusion length in webs. Fabrication of high-efficiency web cells using several web crystals was initiated. These cells will include surface passivation and double-layer antireflection coating. (LEW)

49611 **(EUR—7937) Farm and forest biomass - an energy source for Europe.** Ahner, D.; Farget, M.A. (Commission of the European Communities, Luxembourg). 1983. 219p. (EUR—7937-EN). NTIS, PC E09/MF E09.

A classified bibliography of 1,272 references on the energy-generating uses of biomass has been compiled for the years 1975 to 1980 from enquiries to Ministries of Agriculture and by extracting references from a number of databases (AGREP, AGRICOLA, AGRIS, BIOSIS PREVIEWS, CAB ABSTRACTS, CHEMICAL ABSTRACTS, ENERGYLINE, ENVIROLINE, PASCAL and RESEDA). The bibliography is an attempt to gather European information while keeping it in an international context of work completed or in progress. Searches can be made by author, subject, or geographical indices. The data derived from the classified bibliography are discussed under the headings: the place of energy in agriculture; definitions and conversion routes for energy biomass; energy analysis, a new tool; the potential of biomass as an energy source in Europe; and the socio-economic implications of the use of biomass.

49612 **(N—84-20914) Study of heterojunction solar cells based on n-CdS and several P-type semiconductors.** Arya, R.R. (Brown Univ., Providence, RI (USA)). 1983. 194p. Univ. Microfilms Order No. DA8325947.

Heterojunction solar cells offer several advantages over p-n homojunction solar cells. The window absorber structure reduces the top surface recombination losses which occur in p-n homojunctions. It allows the use of two semiconductors, one of which only is doped n-type and the other only p-type; and some of these semiconductors are deposited by low temperature processes, such as vacuum evaporation, sputtering, or chemical spray pyrolysis. Heterojunction solar cells in which the window material is a thin film of cadmium sulphide were prepared and studied. The cadmium sulphide thin films were deposited by vacuum evaporation from a single resistance heated crucible. A process which rests on the stoichiometry of the CdS source material (powder) and the proper choice of deposition parameters was developed. These films were characterized for their structural, compositional, electrical, and optical behavior.

49613 **(N—84-20916) Voltage controlling mechanisms in low resistivity silicon solar cells: a unified approach.** Weizer, V.G.; Swartz, C.K.; Hart, R.E.; Godlewski, M.P. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). May 1984. 13p. (NASA-TM—83612). NTIS, PC A02/MF A01.

An experimental technique capable of resolving the dark saturation current into its base and emitter components is used as the basis of an analysis in which the voltage limiting mechanisms were determined for a variety of high voltage, low resistivity silicon solar cells. The cells studied include the University of Florida

hi-low emitter cell, the NASA and the COMSAT multi-step diffused cells, the Spire Corporation ion-implanted emitter cell, and the University of New South Wales MINMIS and MINP cells. The results proved to be, in general, at variance with prior expectations. Most surprising was the finding that the MINP and the MINMIS voltage improvements are due, to a considerable extent, to a previously unrecognized optimization of the base component of the saturation current. This result is substantiated by an independent analysis of the material used to fabricate these devices.

49614 **(N—84-21983) Accelerated degradation of silicon metallization systems.** Lathrop, J.W. (Clemson Univ., SC (USA)). Nov 1983. 23p. NTIS, PC A18/MF A01.

Clemson University has been engaged for the past five years in a program to determine the reliability attributes of solar cells by means of accelerated test procedures. The cells are electrically measured and visually inspected and then subjected for a period of time to stress in excess of that normally encountered in use, and then they are reinspected. Changes are noted and the process repeated. This testing has thus far involved 23 different unencapsulated cell types from 12 different manufacturers, and 10 different encapsulated cell types from 9 different manufacturers. Reliability attributes of metallization systems can be classified as major or minor, depending on the severity of the effects observed. As a result of the accelerated testing conducted under the Clemson program, major effects have been observed related to contact resistance and to mechanical adherence and solderability. This paper does not attempt a generalized survey of accelerated test results, but rather concentrates on one particular attribute of metallization that has been observed to cause electrical degradation - increased contact resistance due to Schottky barrier formation. In this example basic semiconductor theory was able to provide an understanding of the electrical effects observed during accelerated stress testing.

49615 **(N—84-21986) Getting the current out.** Burger, D.R. (Jet Propulsion Lab., Pasadena, CA (USA)). Nov 1983. 3p. NTIS, PC A18/MF A01.

Progress of a photovoltaic (PV) device from a research concept to a competitive power-generation source requires an increasing concern with current collection. The initial metallization focus is usually on contact resistance, since a good ohmic contact is desirable for accurate device characterization measurements. As the device grows in size, sheet resistance losses become important and a metal grid is usually added to reduce the effective sheet resistance. Later, as size and conversion efficiency continue to increase, grid-line resistance and cell shadowing must be considered simultaneously, because grid-line resistance is inversely related to total grid-line area and cell shadowing is directly related. A PV cell grid design must consider the five power-loss phenomena mentioned above: sheet resistance, contact resistance, grid resistance, bus-bar resistance and cell shadowing. Although cost, reliability and usage are important factors in deciding upon the best metallization system, this paper will focus only upon grid-line design and substrate material problems for flat-plate solar arrays.

49616 **(N—84-21990) Metallization problems with concentrator cells.** Iles, P.A. (Applied Solar Energy Corp., City of Industry, CA (USA)). Nov 1983. 11p. NTIS, PC A18/MF A01.

Cells used with concentrators have similar contact requirements to other cells, but operation at high intensity imposes more than the usual demands on the metallization. Overall contact requirements are listed and concentrator cell requirements are discussed.

49617 **(N—84-21992) Particle size effects on viscosity of silver pastes: a manufacturer's view.** Provance, J.; Allison, K. (Ferro Corp., Santa Barbara, CA (USA)). Nov 1983. 20p. NTIS, PC A18/MF A01.

Particles from a variety of silver powders were investigated by scanning electron microscopy and particle size analyses. Particle size distribution curves and volume population graphs were prepared for these silver powders and for glass powders with optimum, extra fine and coarse particle sizes. The viscosity at a given shear rate and slope of viscosity over a range of shear rates were determined for thick film pastes made with these powders. Because of particle anomalies and variations, the need for flexibility to achieve the best printing qualities for silver pastes was evident. It was established that print quality, dried and fired film density and optimum contact of silver particles with silicon, important for cell electrical output, could be achieved by adjusting the slope of viscosity that fell outside of the range, -0.550 to -0.650. This was accomplished through organic vehicle technology that permitted a change in the slope of viscosity, up or down, while maintaining a constant silver and total solids content.

49618 **(N—84-21998) Laser assisted deposition.** Dutta, S. (Westinghouse Research and Development Center, Pittsburgh, PA (USA)). Nov 1983. 16p. NTIS, PC A18/MF A01.

Applications of laser-based processing techniques to solar cell metallization are discussed. Laser-assisted thermal or photolytic maskless deposition from organometallic vapors or solutions may provide a viable alternative to photovoltaic metallization systems currently in use. High power, defocused excimer lasers may be used in conjunction with masks as an alternative to direct laser writing to provide higher throughput. Repeated pulsing with excimer lasers may eliminate the need for secondary plating techniques for metal film buildup. A comparison between the thermal and photochemical deposition processes is made.

49619 **(N—84-22008) Chemical bonding technology for terrestrial photovoltaic modules.** Coulter, D.R.; Cuddihy, E.F.; Plueddeman, E.P. (Jet Propulsion Lab., Pasadena, CA (USA)). Nov 1983. 62p. (NASA-CR—173460; JPL—5101-232). NTIS, PC A04/MF A01.

Encapsulated photovoltaic modules must hold together for 20 years, reliably resisting delamination and separation of any of the component materials. Delamination of encapsulation materials from each other, or from solar cells and interconnects, can create voids for accumulation of water, promoting corrosive failure. Delamination of silicone elastomers from unprimed surfaces was a common occurrence with early modules, but the incidences of silicone delamination with later modules decreased when adhesion promoters recommended by silicone manufacturers were used. An investigation of silicone delamination from unprimed surfaces successfully identified the mechanism, which was related to atmospheric oxygen and moisture. This early finding indicated that reliance on physical bonding of encapsulation interfaces for long life in an outdoor environment would be risky. For long outdoor life, the material components of a module must therefore be held together by weather-stable adhesion promoters that desirably form strong, interfacial chemical bonds.

49620 **(N—84-22025) Technical applications of solar energy. Project photovoltaic systems and project selective coatings. Final Report, Feb. 1982.** Gindele, K.; Honstetter, K.; Karl, H.; Koehl, M.; Lehner, G.; Mast, M.; Spohn, C.; Wagner, A. (Stuttgart Univ. (Germany, F.R.)). Dec 1983. 90p. (BMFT-FB-T—83-299). NTIS, PC A05/MF A01.

Long time stability of photovoltaic generators, hybrid collectors, and measuring devices for solar cells and solar cell generators were investigated. No aging of electrical features is stated after 6 yr working, while thermal and electrical efficiencies of collectors amount to 70% and 8% respectively. Radiative properties of selective coatings were measured, composition and structure of selective surfaces, vapor deposition methods (e.g., cermet-coatings), and chemical methods (e.g., cooper-oxide) were investigated. (ESA)

49621 **(NP—5900029) Proposed first edition of the standard for flat-plate photovoltaic modules and panels, UL 1703.** (Underwriters Labs., Inc., Northbrook, IL (USA)). 12 Sep 1984. 71p. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062. File Number TI85900029.

The tentative requirements provided cover flat-plate photovoltaic modules and panels intended for installation on or integral with buildings or to be freestanding (that is, not attached to buildings). Modules and panels intended for use in systems with a maximum system voltage of 1000 volts or less are covered. Also covered are components intended to provide electrical connection to and mounting facilities for flat-plate photovoltaic modules and

panels. The requirements do not cover equipment intended to accept the electrical output from the array (such as inverters and batteries), tracking mechanisms, cell assemblies intended to operate under concentrated sunlight, optical concentrators, or combination photovoltaic-thermal modules or panels. (LEW)

49622 **(NZERDC-P—75) Regional study of land suitability and potential availability for energy farming. Phase I report.** (New Zealand Energy Research and Development Committee, Auckland). May 1983. 166p. NTIS (US Sales Only), PC A08/MF A01. File Number DE85900112.

This study is concerned with developing and demonstrating within the Waikato Region a methodology for determining the potential of energy farming at the regional level, and for assessing its implications for regional development. The Phase I report is largely concerned with crop selection procedures, land suitability assessment for selected crop(s) and the detailing of crop management programmes and growing costs. The regional context is described and an initial identification made of opportunities and constraints to energy farming for subsequent study. The major biomass production options are described and screened according to criteria for further consideration in this study. Agricultural crops as single growing and processing feedstocks, and short rotation energy forest regimes are found to warrant further consideration for large scale energy farming in the Waikato within the next 20 years. A detailed procedure for screening crops associated with the above management options is developed and applied to the Waikato region. From among crops suited to a land resource of the quality and slope necessary for long term arable cropping, the analysis indicates maize grain to be currently the most likely crop on which to base the development of a transport fuels processing industry in the study region. Results from the screening of short rotation forest crops, requiring agricultural quality land for optimal yields, indicated several promising regimes warranting further research. The screening results are indeterminate at present as insufficient field experience and research data are available on which to base detailed suitability assessment. On the basis of tentative costings, however, an indicative comparison is made of fuel production costs between short rotation forest crops and maize grain, grown on similar quality land. This confirms the potential of the former, particularly when converted through to methanol. 101 references, 19 figures, 45 tables.

49623 **(PB—84-200575) High-efficiency multi-colored photovoltaic cells. Final report.** Hovel, H.J. (IBM Watson Research Center, Yorktown Heights, NY (USA)). Sep 1983. 156p. NTIS, PC A08/MF A01.

The objective of this project was to explore tandem/solar cell structures and methods to produce them. The combinations used for the cells were well-established materials. One was made with amorphous Si on crystalline Si, a low-cost structure of moderate potential efficiency (15-20%). Other combinations of well-established materials such as Ge, Si, GaAs, and GaAlAs have a potential of producing solar cell efficiency in a much higher range (30-50%). The theoretical performances of several material combinations were computed under single-load operation, and the effects of series and shunt resistances are shown. Computations also were made of optimal optical coatings and ohmic grid designs that are needed to construct high-efficiency working devices. The epitaxial growth of GaAs, Ge, AlAs and Si are then described for use in several configurations. Additionally, measurements of individual solar cells and tandem solar cells at several 'suns' intensity (starting at one 'sun') are described.

49624 **(SAND—83-7035) Automated installation methods for photovoltaic Arrays II.** Zaremski, D.R. Jr.; Cooper, M.; Briggs, R.L.; Federmann, E. (Burt, Hill, Kosar, Rittlemann, and Associates, Butler, PA (USA). Research and Solar Applications Div.). Jun 1984. Contract AC04-76DP00789. 191p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE85001125.

Standard Installation methods and the automated/mechanized methods considered most likely to reduce the overall installation costs of large photovoltaic arrays are investigated. Details of installation scenarios for standard and mechanized approaches are provided, and the equipment and hardware necessary for each step in the installation process are identified and characterized. To be cost effective, automated installation methods must be integrated early in the design of photovoltaic products and systems.

49625 **(SAND—84-0556) Photovoltaic concentrator technology project.** (Sandia National Labs., Albuquerque, NM (USA)). Jul 1984. Contract AC04-76DP00789. 276p. (CONF-8408116—). NTIS, PC A13/MF A01; 1; GPO Dep. File Number DE85001444.

From 12. photovoltaic concentrator project integration meeting; Albuquerque, NM, USA (28 Aug 1984).

This report is the Proceedings for a meeting on photovoltaic concentrator technology held in Albuquerque, NM, on August 28 & 29, 1984. The meeting covered research on photovoltaic concentrators and their components, including concentrator cells, cell assemblies, Fresnel lenses, concentrator modules, tracking structures and control systems, and complete concentrator arrays. This report contains abstracts and summaries of presentations made at the meeting and status reports for current research contracts.

49626 **(SAND—84-7013) Development of a low-cost extrusion-embossing process for a linear Fresnel lens photovoltaic concentration.** (Entech, Inc., Dallas-Fort Worth Airport, TX (USA)). Sep 1984. Contract AC04-76DP00789. 32p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85000213.

Results of efforts to fabricate linear Fresnel lens using a low-cost extrusion-embossing process indicated that the extrusion-embossing process will be difficult to adapt to the manufacture of efficient lenses. Lenses produced in pilot runs acheived only 72% optical efficiency at 25X geometric concentration ratio, compared to 87% for lenses made by casting or Lensfilm processes. A highly accurate, yet simple, outdoor focal plane flux profile test apparatus was developed that can be used to qualify new lenses and to check the quality of production lenses.

49627 **(SERI/STR—211-2393) Studies of hydrogenated amorphous silicon.** Bishop, S.G.; Carlos, W.E. (Naval Research Lab., Washington, DC (USA)). Jul 1984. Contract AC02-83CH10093. 46p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84013038.

This report discusses the results of probing the defect structure and bonding of hydrogenated amorphous silicon films using both nuclear magnetic resonance (NMR) and electron spin resonance (ESR). The doping efficiency of boron in a-Si:H was found to be less than 1%, with 90% of the boron in a threefold coordinated state. On the other hand, phosphorus NMR chemical shift measurements yielded a ration of threefold to fourfold P sites of roughly 4 to 1. Various resonance lines were observed in heavily boron- and phosphorus-doped films and a-SiC:H alloys. These lines were attributed to band tail states on twofold coordinated silicon. In a-SiC:H films, a strong resonance was attributed to dangling bonds on carbon atoms. ESR measurements on low-pressure chemical-vapor-deposited (LPCVD) a-Si:H were performed on samples. The defect density in the bulk of the films was 10^{17}/cc with a factor of 3 increase at the surface of the sample. The ESR spectrum of LPCVD-prepared films was not affected by prolonged exposure to strong light. Microcrystalline silicon samples were also examined. The phosphorus-doped films showed a strong signal from the crystalline material and no resonance from the amorphous matrix. This shows that phosphorus is incorporated in the crystals and is active as a dopant. No signal was recorded from the boron-doped films.

49628 **n-$CuInSe_2$ based photoelectrochemical cells: Improved, stable performance in aqueous polyiodide through rational surface and solution modifications.** Cahen, D.; Chen, Y. (Solar Energy Research Institute, Golden, Colorado 80401). *Applied Physics Letters;* **45**: No. 7, 746-748(1 Oct 1984). Contract AC02-83CH10093.

Surface optimization of n-$CuInSe_2$ crystals by chemical etching in Br_2/MeOH and subsequent thermal oxidation results in >10% efficient photanodes in neutral aqueous polyiodide. The etchant removes a near-stoichiometric surface layer and thermal oxidation leads to In—O bond formation. We find from (photo) electrochemical studies in acetonitrile and in the iodide electrolyte that, upon semiconductor decomposition, Cu ions are released into the

solution, consistent with solid state chemical studies that show the existence of the chalcopyrite phase also towards Cu-poor compositions. Addition of Cu ions, as also reported by S. Menezes, H. J. Lewerenz, and K. J. Bachmann [Nature (London) 305, 615 (1983)] or Cu and In ions to the iodide solution drastically decreases photoanode decomposition. Covering the electrode with an extra film of oxidized indium results in true stabilization, at up to 11.7% conversion efficiency under 120-mW/cm² tungsten-halogen illumination. Because, in the presence of Cu ions and under illumination, iodide solutions are not completely stable towards oxidation by O_2, especially if the solution is acidic, an air-free electrolyte needs to be used.

49629 **Electronic properties versus composition of thin films of $CuInSe_2$.** Noufi, R.; Axton, R.; Herrington, C.; Deb, S.K. (Solar Energy Research Institute, Golden, Colorado 80401). *Applied Physics Letters;* 45: No. 6, 668-670(15 Sep 1984). Contract AC02-83CH10093.

The electrical properties of thin-film $CuInSe_2$ (<4 μm thick) deposited by coevaporation of the elements have been measured by different techniques as a function of material composition. A correlation between the Cu/In and Se/metal ratios versus majority-carrier concentration is established. A qualitative scheme is developed, based on experiments, which predicts the majority-carrier type and concentration in relation to the stoichiometry of the material.

49630 **Photoelectrochemical cells for conversion of solar energy to electricity and methods of their manufacture.** Skothein, T. (to Dept. of Energy). US Patent 4,442,185. 10 Apr 1984. Filed date 9 Jun 1982. vp.

PAT-APPL-386666.

A photoelectric device is disclosed which comprises first and second layers of semiconductive material, each of a different bandgap, with a layer of dry solid polymer electrolyte disposed between the two semiconductor layers. A layer of a polymer blend of a highly conductive polymer and a solid polymer electrolyte is further interposed between the dry solid polymer electrolyte and the first semiconductor layer. A method of manufacturing such devices is also disclosed.

49631 **Polymers in solar energy utilization.** Liang, R.H.; Coulter, D.R.; Dao, C.; Gupta, A. (California Inst. of Tech., Pasadena). pp 265-273 of Polymers in solar energy utilization. Washington, DC, USA; American Chemical Society (1983). (CONF-820304—).

From 183. American Chemical Society annual meeting; Las Vegas, NV, USA (27 Mar 1982).

A laser photoacoustic technique (LPAT) has been verified for performing accelerated life testing of outdoor photooxidation of polymeric materials used in solar energy applications. Samples of the material under test are placed in a chamber with a sensitive microphone, then exposed to chopped laser radiation. The sample absorbs the light and converts it to heat by a nonradiative deexcitation process, thereby reducing pressure fluctuations within the cell. The acoustic signal detected by the microphone is directly proportional to the amount of light absorbed by the specimen. Tests were performed with samples of ethylene/methylacrylate copolymer (EMA) reprecipitated from hot cyclohexane, compressed, and molded into thin (25-50 microns) films. The films were exposed outdoors and sampled by LPAT weekly. The linearity of the light absorbed with respect to the acoustic signal was verified. Correlations were established between the photoacoustic behavior of the materials aged outdoors and the same kinds of samples cooled and heated in a controlled environment reactor. The reactor tests were validated for predicting outdoor exosures up to 55 days. 5 references.

49632 **Interaction between cast silicon properties and solar cell performance.** Hyland, S.; Iles, P.; Leung, D. (California Inst. of Tech., Pasadena). pp 68-73 of Photovoltaic specialists conference. New York, NY, USA; Institute of Electrical and Electronics Engineers (1982). (CONF-820906—).

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

Three types of cast silicon, Silso, HEM (Heat-Exchanger Method) and UCP (Ubiquitous Crystallization Process) were studied for their use as solar cells. Optical microscopy after etching revealed a high density of uniform dislocations (approaching 1,000,000/sq cm), lines of dislocations indicating stress during crystal growth, and precipitates, some of which generate dislocations. Solar cells were fabricated by three processes. Results of solar cell processing revealed that these materials produce cells of lower efficiency than Czochralski control cells, and that the efficiencies of the three materials were quite close. Diffusion length and spectral response data are shown. Certain structural features are correlated with solar cell efficiency, diffusion length, and spectral response. Electron-beam induced current (EBIC) and light spot scanning are used to back up other measurements. 11 references.

49633 **Progress in growth of silicon ribbon by a low angle, high rate process.** Jewett, D.N.; Bates, H.E.; Locher, J.W. (Energy Materials Corp., South Lancaster, MA). pp 86-89 of Photovoltaic specialists conference. New York, NY, USA; Institute of Electrical and Electronics Engineers (1982). (CONF-820906—).

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

Substantial progress has been achieved in the development of the Low Angle Silicon Sheet (LASS) crystal growth technique since its inception in mid 1979. Continuously grown ribbons of 10 to 30 meters are produced routinely at growth rates of 10 to 80 cm/min. Ribbon widths are 4 to 15 cm and thickness varies from 0.3 to 6 mm with 0.5 mm typical. At an average growth speed of 30 cm/min and a width of 15 cm, productivity of 450 sq cm/min of ribbon has been demonstrated. Solar cells made from LASS material have exhibited up to 12.9 percent conversion efficiency (AMI) on 4 x 4 cm boron doped blanks.

49634 **High efficiency silicon solar cells.** Weaver, H.T.; Nasby, R.D. (Sandia National Labs., Albuquerque, NM). pp 361-365 of Photovoltaic specialists conference. New York, NY, USA; Institute of Electrical and Electronics Engineers (1982). (CONF-820906—).

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

A summary of data on high-performance silicon solar cells is presented. Cells are discussed which represent state-of-the-art single-crystal silicon devices and which exhibit power-conversion efficiencies above 20 percent at concentration. One group of p(+)-n cells exhibited open-circuit voltages (Voc) as high as 0.653 V at one-sun insolation. This large Voc suggests that bandgap-narrowing effects are smaller than has been assumed in the past for this type cell. 10 references.

49635 **Impurities in polycrystalline silicon solar cells.** Rohatgi, A.; Davis, J.R.; Hopkins, R.H.; Rai-Choudhury, P. (Westinghouse Research and Development Center, Pittsburgh, PA). pp 411-416 of Photovoltaic specialists conference. New York, NY, USA; Institute of Electrical and Electronics Engineers (1982). (CONF-820906—).

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

The effects of grain boundaries and impurities on silicon-solar-cell performance have been studied in single-crystal and polycrystalline ingots by intentionally incorporting 2 x 10 to the 12th/cu cm Mo, 10 to the 14th/cu cm Ti, and about 10 to the 15th/cu cm Cr during Czochralski growth. Mo, Ti, and Cr degrade solar-cell performance by inducing deep levels in silicon. Electrically active grain boundaries also reduce cell performance by inducing carrier recombination in the bulk as well as in the depletion region. At low impurity concentrations, polycrystalline cell performance is controlled by grain-boundary recombination, while at high concentrations, it is dominated by the impurity, resulting in equal efficiencies for single-crystal and polycrystalline cells. Impurity/grain-boundary interactions are species dependent and result in a decrease in impurity-induced deep-level concentration: Cr exhibits the largest interaction, Ti a weak interaction, and Mo no measurable effect. 16 references.

49636 **Studies of grain boundaries in small-grained polycrystalline silicon solar cells.** Young, R.T.; Van Der Leeden, G.A. (Oak Ridge National Lab., TN). pp 427-430 of Photovoltaic specialists conference. New York, NY, USA; Institute of Electrical and Electronics Engineers (1982). (CONF-820906—). Contract W-7405-ENG-26.

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

Progress in the development of small-grained (10-100-micron) polycrystalline-Si solar cells is hampered by the present poor knowledge of the physical and chemical properties of grain boundaries and the lack of satisfactory processing techniques for junction formation. Grain boundaries and their effects in polycrystalline silicon with grain sizes of 1-2 mm and in smaller-grained material with grain sizes of 10 and 40-50 microns are studied. Results for various recombination effects observed in the large-grained material are described, and the influence of lithium passivation on the electrical properties of the small-grained material and on the characteristics of solar cells made from it are reported.

49637 **Enhanced diffusion of phosphorus at grain boundaries.** Cheng, L.J.; Shyu, C.M.; Stika, K.M.; Daud, T.; Crotty, G.T. (California Inst. of Tech., Pasadena). pp 554-558 of Photovoltaic specialists conference. New York, NY, USA; Institute of Electrical and Electronics Engineers (1982). (CONF-820906—).

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

Enhanced diffusion of phosphorus at grain boundaries in cast polycrystalline photovoltaic materials (Wacker, HEM, and Semix) was studied. It was found that the enhancements for the three materials were the same, indicating that the properties of boundaries are similar, even though they were grown by different techniques. In addition, it was observed that grain boundaries capable of enhancing the diffusion always have strong recombination activities. Both phenomena could be related to dangling bonds existing at the boundaries. The present study gives the first evidence that incoherent second order twins of 111/115-plane type are diffusion-active. 9 references.

49638 **V-Groove silicon solar cell.** Borden, P.G.; Walsh, R. (Varian Associates, Palo Alto, CA). pp 574-577 of Photovoltaic specialists conference. New York, NY, USA; Institute of Electrical and Electronics Engineers (1982). (CONF-820906—).

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

The V-Groove silicon solar cell is designed to achieve high concentration. It uses a v-groove front surface to obtain minimal grid shadowing losses, while allowing high fractional grid coverage. The serrated structure and front surface refraction minimizes the photon penetration depth, reducing the required diffusion length and allowing use of epitaxial layers on highly doped substrates. This minimizes base resistance. Cells have achieved 17.4 percent AM1 efficiency at 200 suns, 24 C, with 25 percent front grid coverage. 10 references.

49639 **Stability of thin-film Cu2S-based solar cells at Voc under continuous illumination.** Phillips, J.E.; Birkmire, R.W.; Lasswell, P.G. (Delaware Univ., Newark). pp 719-722 of Photovoltaic specialists conference. New York, NY, USA; Institute of Electrical and Electronics Engineers (1982). (CONF-820906—).

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

Thin-film Cu2S-based solar cells have been developed which are free of the shunting defects that cause the electrochemical decomposition of the Cu2S. These cells have been held at open-circuit voltage under continuous illumination in an inert or reducing atmosphere for over 500 hours with no degradation in efficiency, short-circuit current, or open-circuit voltage. Laser scanning techniques have been developed as a tool for detecting cell defects and recently, these techniques have been used to locate shunting defects in ungridded Cu2S-based cells. By using the laser scanner, it has been possible to detect and eliminate defects that cause electrochemical decomposition of the Cu2S. 11 references.

49640 **Empirical testing of an analytical model predicting electrical isolation of photovoltaic models.** Garcia, A. III; Minning, C.P.; Cuddihy, E.F. (Spectrolab, Inc., Sylmar, CA). pp 1014-1019 of Photovoltaic specialists conference. New York, NY, USA; Institute of Electrical and Electronics Engineers (1982). (CONF-820906—).

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

A major design requirement for photovoltaic modules is that the encapsulation system be capable of withstanding large DC potentials without electrical breakdown. Presented is a simple analytical model which can be used to estimate material thickness to meet this requirement for a candidate encapsulation system or to predict the breakdown voltage of an existing module design. A series of electrical tests to verify the model are described in detail. The results of these verification tests confirmed the utility of the analytical model for preliminary design of photovoltaic modules. 7 references.

49641 **Estimation of magnitude and frequency of occurrence of high cell temperatures in reverse bias.** Lambarski, T.J.; Anderson, E.R. (BDM Corp., Albuquerque, NM). pp 1020-1024 of Photovoltaic specialists conference. New York, NY, USA; Institute of Electrical and Electronics Engineers (1982). (CONF-820906—).

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

The worst-case temperature is determined for solar cells with different shunt resistances in bypass groups of different lengths in reverse bias conditions caused by partial shadowing. The module analyzed contains 36 series-connected 4-inch-diameter cells with bypass diodes across each 18 cells the condition of one bypass diode across 36 cells was also examined. The models for implementation into SOLCEL II and the required modifications to SOLCEL II are clarified. Results are presented in charts of daily highs and lows and histograms of temperature occurrence for the entire year the module was considered to be located in El Paso, TX. It is shown that the cell temperature will be lower for multiple cell shadowing or different shadow fractions. It is also shown that periodic array cleaning will prevent any single cell from experiencing the frequency of occurrence of high temperature demonstrated in the analysis.

49642 **Progress in the SERI-DOE Photoelectrochemical Cell Program.** Wallace, W. (Solar Energy Research Inst., Golden, CO). pp 1066-1071 of Photovoltaic specialists conference. New York, NY, USA; Institute of Electrical and Electronics Engineers (1982). (CONF-820906—). Contract FC01-79ER10000.

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

The concept of photoelectrochemical storage has been investigated and demonstrated in studies involving three electrode in situ and four electrode redox storage cells. For these cells system efficiencies of 1-3 percent have been obtained to date for the net conversion of light energy into electrical energy. SERI also monitors the technical progress in the Texas Instruments Solar Energy System program which involves conversion of light energy into electrical and thermal energy in a system which incorporates electrochemical storage. Progress in the Texas Instruments program is reviewed for FY 82. Research on polycrystalline thin film n-CdSe and n-CdSe/x/Te/1-x/ based electrochemical photovoltaic cells has resulted in the achievement of efficiencies up to 7 percent for the direct conversion of light energy into electrical energy without storage in devices containing a sulfide/polysulfide electrolyte. Higher efficiencies are possible with improved polycrystalline thin films and alternate electrolytes. 15 references.

49643 **Cu/Cu2O cells prepared by hydrogen bombardment.** Trivich, D.; Fish, D.L. (Wayne State Univ., Detroit, MI). pp 1072-1077 of Photovoltaic specialists conference. New York, NY, USA; Institute of Electrical and Electronics Engineers (1982). (CONF-820906—). Contract AC02-81ER10825.

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

A new method for preparing Cu/Cu2O cells involves bombardment of Cu2O by a beam of hydrogen ions. The cells have an open-circuit voltage up to 0.72 V, compared with 0.35 V for cells made by thermal evaporation of Cu on Cu2O. Auger studies show that the hydrogen bombardment reduces the top surface of the Cu2O to Cu, creating the Cu/Cu2O junction. The optimum processing conditions are bombardment at 250 V for 75s at 15 mA. The surface resistivity of the Cu film decreases with bombardment time, but 75s gives adequate continuity in the film. Electron diffraction shows the Cu is formed epitaxially on the Cu2O. Encapsulated cells are relatively stable. The conversion efficiency has reached 1.3 percent for 1 sq cm cells. 7 references.

49644 **Optimization of a-Si solar cell current collection.** Gupta, Y.; Liers, H. (Science Applications, Inc., McLean, VA). pp 1092-1101 of Photovoltaic specialists conference. New York, NY, USA; Institute of Electrical and Electronics Engineers (1982). (CONF-820906—). Contract AC02-77CH00178.

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

This paper develops a quantitative methodology to evaluate power losses resulting from current collection in a-Si:H modules. Analytic expressions are derived for optimum cell width and grid spacing as a function of design parameters for series cells with and without metallic collection grids. Current collection losses can be reduced to about 2 percent using optimized designs with fairly narrow cell widths of less than a centimeter. The methodology can also be used to evaluate power losses for other thin film technologies such as CdS.

49645 **Amorphous silicon materials and solar cells: progress and directions.** Sabisky, E.; Mahan, H.; Mcmahon, T. (Solar Energy Research Inst., Golden, CO). pp 1106-1110 of Photovoltaic specialists conference. New York, NY, USA; Institute of Electrical and Electronics Engineers (1982). (CONF-820906—). Contract AC02-77CH00178.

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

In 1978, the U.S. Department of Energy initiated government sponsored research in amorphous materials and thin film solar cells. The program was subsequently transferred to the Solar Energy Research Institute for program management. The program grew into a major program for the development of high efficiency (greater than 10 percent), cost effective (15-40 cents per peak watt) thin film amorphous solar cells. The present international interest, the substantial progress made in the device area (2 percent PIN cell in 1976 to 10 percent PIN cell in 1982), and the marketing of the first consumer products using thin film solar cells are to a large extent a consequence of this goal-oriented program. 17 references.

49646 **Disilane versus monosilane: a comparison of the properties of glow-discharge a-Si:H films and solar cells.** Delahoy, A.E.; Kampas, F.J.; Corderman, R.R. (Chronar Corp., Princeton, NJ). pp 1117-1123 of Photovoltaic specialists conference. New York, NY, USA; Institute of Electrical and Electronics Engineers (1982). (CONF-820906—). Contract AC02-76CH00016.

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

The consequences of using disilane instead of silane for the glow-discharge deposition of a-Si:H solar cells have been studied. Deposition rates were increased fivefold by the use of disilane. The a-Si:H films have a higher hydrogen content, but otherwise are quite similar to silane produced films and possess the same type of gap states. Chlorosilanes, HCl, and oxysilanes were detected in the disilane by mass spectrometry and their influence on film and solar cell properties assessed. The problem of inadvertent dopant tails resulting from the higher deposition rate of the solar cells is identified. 23 references.

49647 **10 percent efficient ITO-CdTe heterojunction solar cell.** Werthen, J.G.; Anthony, T.C.; Fahrenbruch, A.L.; Bube, R.H. (Stanford Univ., CA). pp 1138-1142 of Photovoltaic specialists conference. New York, NY, USA; Institute of Electrical and Electronics Engineers (1982). (CONF-820906—).

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

ITO/CdTe heterojunctions have been formed by electron beam evaporation of indium-tin-oxide (ITO) onto single crystal p-type CdTe and onto close-spaced-vapor-transport (CSVT) CdTe films deposited on single crystal p-type CdTe. Solar efficiencies of 10.5 percent referred to active area Voc 0.81 V, Jsc 20 mA/sq cm have been realized with junctions on single crystal CdTe. These heterojunctions have been stable for 10 months. The exploratory ITO/p-CdTe(CSVT)/p-CdTe(single crystal) heterojunctions show Voc 0.46 V, Jsc 20.0 mA/sq cm and a solar efficiency of 5.5 percent. 11 references.

49648 **Review of PV module performance at DOE/MIT Lincoln Laboratory test sites during the period 1977-1982.** Forman, S.E.; Themelis, M.P. (MIT, Lexington, MA). pp 1198-1207 of Photovoltaic specialists conference. New York, NY, USA; Institute of Electrical and Electronics Engineers (1982). (CONF-820906—).

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

During the years 1977-1982, MIT Lincoln Laboratory placed over 11,000 photovoltaic (PV) modules at experimental PV power generating systems in a number of field test sites in the United States. Prominent among these are a 100-kW system at Natural Bridges National Monument in Utah, a 25-kWp system at Mead, Nebraska, and a 15-kW system at Bryan, Ohio. The modules used in each of these systems were procured through the Jet Propulsion Laboratory's Large Scale Procurement Program as part of the U.S. Department of Energy's National Photovoltaic Program. Through a program of periodic surveillance, measurements, and inspections at the aforementioned sites, electrically failed modules were located, removed and analyzed during this six-year period. The principal causes of failure were: (1) cells cracked due to weathering or internal module stresses, (2) failed solder joints, (3) interconnects not soldered to rear sides of cells at assembly, (4) cells or interconnects electrically shorted to metallic substrates, and (5) broken or split interconnects. Details and photographs of many of the different types of failures are presented, and some of the analysis techniques used to locate the failures are described. 6 references.

49649 **Empirical testing of structural deflection modeling of large photovoltaic modules.** Duncan, L.B.; Minning, C.P.; Garcia, A. III. (Hughes Aircraft Co., El Segundo, CA). pp 1256-1261 of Photovoltaic specialists conference. New York, NY, USA; Institute of Electrical and Electronics Engineers (1982). (CONF-820906—).

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

The objective of the structural deflection test was to verify the analytical models used to predict solar cell stress, load-bearing layer stress, and module deflection that result from a uniform pressure load on the module surface. The verification process consisted of measuring module deflection, stress in the solar cell, and stress in the load-bearing member as a functon of normal pressure load, pottant modulus of elasticity, pottant thickness, and cell location. Four glass superstrate modules, two plain wood substrate modules, two ribbed wood substrate modules, and a steel substrate module were tested. Consistent with analysis predictions, all unribbed specimens exhibited nonlinear load vs. deflection characteristics. With the exception of the steel module, test results and analysis predictions for panel deflectons agreed to within 10 percent. A wider variation of agreement was found for stress in the load-bearing members and cells.

49650 **Design solutions for the solar cell interconnect fatigue fracture problem.** Mon, G.R.; Ross, R.G. Jr. (California Inst. of Tech., Pasadena, CA). pp 1268-1276 of Photovoltaic specialists conference. New York, NY, USA; Institute of Electrical and Electronics Engineers (1982). (CONF-820906—).

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

Mechanical fatigue of solar cell interconnects is a major failure mechanism in photovoltaic arrays. A comprehensive approach to the reliability design of interconnects, together with extensive

design data for the fatigue properties of copper interconnects, has been published. This paper extends the previous work, developing failure prediction (fatigue) data for additional interconnect material choices, including aluminum and a variety of copper-Invar and copper-steel claddings. An improved global fatigue function is used to model the probability-of-failure statistics of each material as a function of level and number of cycles of applied strain. Life-cycle economic analyses are used to evaluate the relative merits of each material choce. The copper-Invar clad composites demonstrate superior performance over pure copper. Aluminum results are disappointing. 9 references.

49651 **Attainment of 10 percent conversion efficiency in amorphous silicon solar cells.** Catalano, A.; Daiello, R.V.; Dresner, J.; Faughnan, B.; Firester, A.; Kane, J.; Schade, H.; Smith, Z.E.; Swartz, G.; Triano, A. (RCA Labs., Princeton, NJ). pp 1421-1422 of Photovoltaic specialists conference. New York, NY, USA; Institute of Electrical and Electronics Engineers (1982). (CONF-820906—).

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

For the first time, the attainment of conversion efficiencies of over 10 percent in single junction devices has been reported. This result has been achieved by means of a loss minimization procedure. The present investigation is concerned with the approaches employed to reduce the losses and with the device parameters of the resulting high efficiency solar cell. All devices were prepared by means of a method involving the plasma decomposition of silane. The light losses within the obtained a-Si:H device were reduced by making use of a wide bandgap silicon carbide p-layer, combined with a relatively long diffusion length i-layer. In addition, a reflecting back contact was incorporated to achieve a device efficiency of 10.1 percent. 5 references.

49652 **Ultrathin GaAs and AlGaAs solar cells.** Boettcher, R.J.; Borden, P.G.; Ludowise, M.J. (Varian Associates, Inc., Palo Alto, CA). pp 1470-1473 of Photovoltaic specialists conference. New York, NY, USA; Institute of Electrical and Electronics Engineers (1982). (CONF-820906—).

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

Techniques for making 3 to 10 micron thick AlGaAs and GaAs solar cells by stop etching are described. The method is to grow a normal structure with a 90 percent AlGaAs layer buried below the base. The emitter contact is formed and the cell bonded to a cover glass the substrate is then etched away. The process and test results are given. Also described is a back surface reflector (BSR) for such a cell. 8 references.

1406 Photovoltaic Power Systems

REFER ALSO TO CITATION(S) 14060049602, 49608

49653 **(DOE/BP—326) Signal Hill solar-powered repeater report and recommendations.** Smith, G.R. (USDOE Bonneville Power Administration, Portland, OR). Aug 1984. 29p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85000487.

Partially-active repeaters (PAR) are radios that do not remodulate but instead directly amplify the signals passing through them. The PAR discussed in this report is the GTE Lenkurt 700C1 repeater developed under contract for BPA. The 700C1 repeater is the first radio of its kind to operate in the 7/8 GHz frequency band. The repeater uses only 25 watts because it is based on a simple, nonfrequency-converting design. This compares to at least 350 watts for a fully-active repeater. The 700C1's low power consumption makes it ideal to be powered by solar voltaic cells. A new PAR site costs substantially less to develop than a fully active repeater since less support equipment is needed, no a-c power has to be brought to the site, and the building can be as small as 6' X 6'. There should also be a savings in maintenance costs, as compared to a fully-active repeater, since the 700C1 repeater has only a few active components to maintain. The 700C1 repeater also alleviates many of the engineering problems related to passive repeaters. A prototype 700C1 solar-powered repeater was installed at Signal Hill, Oregon, in November 1981, to eventually replace the existing poor microwave path between Big Eddy Substation and Wasco Radio Station. The repeater's RF performance is better than BPA's original specfications. The solar panels were not generating power during the winter months, so additional solar panels were added in May 1982. There have been no problems since. The new microwave path between Wasco and Big Eddy, via Signal Hill, is a large improvement over the previous path, which was via a double passive repeater: noise levels have been reduced and signal strength improved. The only major disadvantage to the 700C1 repeater is that there currently is no product on the market to relay alarm information (i.e., low battery alarm, etc.) to maintenance personal. Such an alarm system is technically possible, but at this point no company is pursuing its development.

49654 **(N—84-22009) Photovoltaic power conditioning subsystem: state of the art and development opportunities.** Krauthamer, S.; Bahrami, K.; Das, R.; Macie, T.; Rippel, W. (Jet Propulsion Lab., Pasadena, CA (USA)). Jan 1984. 187p. (NASA-CR—173458; JPL—5220-21). NTIS, PC A09/MF A01.

Photovoltaic systems, the state of the art of power conditioning subsystem components, and the design and operational interaction between photovoltaic systems and host utilities are detailed in this document. Major technical issues relating to the design and development of power conditioning systems for photovoltaic application are considered. These include: (1) standards, guidelines, and specifications, (2) cost effective hardware design, (3) impact of advanced components on power conditioning development, (4) protection and safety, (5) quality of power, (6) system efficiency, and (7) system integration with the host utility. Theories of harmonic distortion and reactive power flow are discussed, and information about power conditioner hardware and manufacturers is provided.

49655 **Simulated performance of the Texas Instruments Solar Energy System in various U.S. cities.** Hotchkiss, G.B.; Chang, R.R. (Texas Instruments Co., Dallas, TX). pp 511-517 of Solar Engineering – 1984. Yogi Goswami, D. New York, NY, USA; A.S.M.E. (1984). (CONF-840402—).

From 6. annual ASME Solar Energy Division technical conference; Las Vegas, NV, USA (10 Apr 1984).

The Texas Instruments Solar Energy System (TISES) is a closed-loop electrochemical photovoltaic energy system which converts solar energy into chemical energy by electrolyzing hydrobromic acid (HBr). The electrolysis produces hydrogen gas which is stored in the form of a solid metal hydride and bromine which dissolves in the HBr. On demand these chemicals are recombined in a fuel cell subsystem to produce electrical power. Useful thermal energy is also collected by means of flat-plate solar heat collectors. Using an executive routine called SIXPAK, a set of system models were developed and used to simulate the performance of residential-sized systems. Results are shown of TISES simulations for a typical all-electric residence located in the following U.S. cities: Albuquerque, NM; Boston, MA; Dallas-Fort Worth, TX; Kansas City, MO; Los Angeles, CA; Phoenix, AZ; San Diego, CA; and Tampa, FL. For each site a residential energy demand model was developed and used in 8760 hourly increments against SOLMET data.

49656 **Photovoltaic-electrolyzer system transient simulation results.** Leigh, R.W.; Metz, P.D.; Michalek, K. (Brookhaven National Laboratory, Upton, NY). pp 544-550 of Solar Engineering – 1984. Yogi Goswami, D. New York, NY, USA; A.S.M.E. (1984). (CONF-840402—).

From 6. annual ASME Solar Energy Division technical conference; Las Vegas, NV, USA (10 Apr 1984).

Brookhaven National Laboratory is developing an integrated test bed to illustrate advanced hydrogen technology. The first phase of this effort will investigate the use of solar energy to produce hydrogen from water via photovoltaic-powered electrolysis. A coordinated program of system testing, computer simulation, and economic analysis has been adopted to characterize and optimize the photovoltaic-electrolyzer system. This paper presents the initial transient simulation results. Innovative features of the modeling include the use of real weather data, detailed hourly modeling of the thermal characteristics of the PV array and of system control strategies, and examination of systems over a wide range of power

and voltage ratings. The transient simulation system TRNSYS was used, incorporating existing, modified or new component subroutines as required. For directly coupled systems, we found the PV array voltage which maximizes hydrogen production to be quite near the nominal electrolyzer voltage for a wide range of PV array powers. The array voltage which maximizes excess electricity production is slightly higher. The use of an ideal (100% efficient) maximum power tracking system provides only a six percent increase in annual hydrogen production. An examination of the effect of PV array tilt indicates, as expected, that annual hydrogen production is insensitive to tilt angle within + or - 20° of latitude. Summer production greatly exceeds winter generation. Tilting the array, even to 90°, produces no significant increase in winter hydrogen production.

49657 **Utility interface issues for grid-connected photovoltaic systems.** Chu, D.; Key, T. (Sandia National Labs., Albuquerque, NM). pp 391-395 of Photovoltaic specialists conference. New York, NY, USA; Institute of Electrical and Electronics Engineers (1982). (CONF-820906—).

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

Photovoltaic (PV) balance-of-system research and development has focused on interconnection with the utility grid as the most promising future application for photovoltaic energy production. These sysems must be compatible with the existing utility grid to be accepted. Compatibility encompasses many technical, economic and institutional issues, from lineman safety to revenue metering and power quality. This paper reviews DOE/PV sponsored research for two of the technical interconnection issues: harmonic injection, and power factor control. Explanations and rationale behind these two issues will be reviewed, and the status of current research and plans for required future work will be presented. 12 references.

49658 **Reliability, availability and maintenance-costs models for use in the design of photovoltaic power systems.** Stember, L.H. (Battelle Columbus Labs., Columbus, OH). pp 1036-1040 of Photovoltaic specialists conference. New York, NY, USA; Institute of Electrical and Electronics Engineers (1982). (CONF-820906—).

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

Two techniques were developed for modeling the availability and maintenance costs of photovoltaic power systems. Their use permits the incorporation of reliability and maintenance cost considerations during design. The paper describes the technical approach; the techniques developed, the input data required, and the output information generated by the techniques. Flow charts and example inputs and outputs are provided to illustrate the techniques capabilities. 5 references.

49659 **Cost analyses of modular flat-panel and concentrator photovoltaic array fields.** Carmichael, D.C. (Battelle Columbus Labs., Columbus, OH). pp 1176-1182 of Photovoltaic specialists conference. New York, NY, USA; Institute of Electrical and Electronics Engineers (1982). (CONF-820906—).

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

Modular designs for a flat-panel array field and for two types of concentrator array fields have been developed which reduce the array-field balance-of system (BOS) costs and engineering design costs to a fraction of those experienced in previous installations. To achieve the BOS cost reductions, array-field subsystem designs were integrated and optimized for minimum life-cycle costs. It is shown that the array-field BOS costs for the developed building-block designs contribute only 0.89 to 1.22 cents/kWh (ac) to the levelized energy cost of the electricity generated by the photovoltaic system. 10 references.

49660 **Design and installation experiences from nine intermediate-sized photovoltaic systems: a critical analysis.** Burgess, E.L.; Biringer, K.L. (Sandia National Lab., Albuquerque, NM). pp 1189-1197 of Photovoltaic specialists conference. New York, NY, USA; Institute of Electrical and Electronics Engineers (1982). (CONF-820906—).

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

Nine intermediate-sized photovoltaic system experiments have been constructed as part of the U.S. Department of Energy's National Photovoltaic Program. The purpose of these application-oriented experiments is to provide experience in the design, construction, and operation of full-scale, on-site photovoltaic systems. This paper summarizes the vast experience gained during the design and installation phases of the projects, and anlayzes this experience with respect to its implications on future designs. 8 references.

49661 **Progress at the Southwest Residential Experiment Station.** Schaefer, J.F.; Lieberman, M.A. (New Mexico State Univ., Las Cruces). pp 1355-1361 of Photovoltaic specialists conference. New York, NY, USA; Institute of Electrical and Electronics Engineers (1982). (CONF-820906—). Contract AC04-82AL20090.

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

Results are presented from the continuing performance evaluation of eight prototype residential photovoltaic systems at the Southwest Residential Experiment Station (SW RES) in Las Cruces, NM. Additionally, data from the occupied residence monitoring program in Las Cruces and an overview of present and planned activity at the SW RES is included. An extensive summary of lessons learned through the first 18 months of SW RES operation is provided.

49662 **Residential photovoltaic power conditioning technology for grid connected applications.** Key, T.S.; Klein, J.W. (Sandia National Lab., Albuquerque, NM). pp 1456-1458 of Photovoltaic specialists conference. New York, NY, USA; Institute of Electrical and Electronics Engineers (1982). (CONF-820906—).

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

Major advances in photovoltaic (PV) Power Conditioning (PC) with respect to performance and low-cost potential have been made. Solutions have been obtained to interface and control problems related to adapting available inverter designs to the grid-connected, residential photovoltaic experiments. A description is presented to contributing research and development activities. Attention is given to aspects of residential systems experience, conceptual design studies, questions of optimum topology development, and promising advanced designs for residential PV provided by development efforts of the private sector.

1407 Solar Thermal Power Systems

REFER ALSO TO CITATION(S) 14070049707

49663 **(DOE/JPL—1060-66) Wind loading on solar concentrators: some general considerations.** Roschke, E.J. (Jet Propulsion Lab., Pasadena, CA (USA)). 1 May 1984. Contract AM04-80AL13137. 153p. (JPL-PUB—83-101). NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE85000337.

A survey has been completed to examine the problems and complications arising from wind loading on solar concentrators. Wind loading is site specific and has an important bearing on the design, cost, performance, operation and maintenance, safety, survival, and replacement of solar collecting systems. Emphasis herein is on paraboloidal, two-axis tracking systems. Thermal receiver problems also are discussed. Wind characteristics are discussed from a general point of view; current methods for determining design wind speed are reviewed. Aerodynamic coefficients are defined and illustrative examples are presented. Wind tunnel testing is discussed, and environmental wind tunnels are reviewed; recent results on heliostat arrays are reviewed as well. Aeroelasticity in relation to structural design is discussed briefly. Wind loads, i.e., forces and moments, are proportional to the square of the mean wind velocity. Forces are proportional to the square of concentrator diameter, and moments are proportional to the cube of diameter. Thus, wind loads have an important bearing on size selection from both cost and performance standpoints. It is concluded that sufficient information exists so that reasonably accurate predictions of wind

loading are possible for a given paraboloidal concentrator configuration, provided that reliable and relevant wind conditions are specified. Such predictions will be useful to the design engineer and to the systems engineer as well. Information is lacking, however, on wind effects in field arrays of paraboloidal concentrators. Wind tunnel tests have been performed on model heliostat arrays, but there are important aerodynamic differences between heliostats and paraboloidal dishes.

49664 **(DOE/JPL—1060-74) Nomographic methodology for use in performance trade-off studies of parabolic dish solar power modules.** Selcuk, M.K.; Fujita, T. (Jet Propulsion Lab., Pasadena, CA (USA)). 15 Jun 1984. Contract AM04-80AL13137. 61p. (JPL-PUB—84-39). NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85000323.

A simple graphical method has been developed to undertake technical design trade-off studies for individual parabolic dish modules comprising a two-axis tracking parabolic dish with a cavity receiver and power conversion assembly at the focal point. The results of these technical studies can then be used in performing the techno-economic analyses required for determining appropriate subsystem sizing. Selected graphs that characterize the performance of subsystems within the module have been arranged in the form of a nomogram that would enable an investigator to carry out several design trade-off studies. Key performance parameters encompassed in the nomogram include receiver losses, intercept factor, engine rating, and engine efficiency. Design and operation parameters such as concentrator size, receiver type (open or windowed aperture), receiver aperture size, operating temperature of the receiver and engine, engine partial load characteristics, concentrator slope error, and the type of reflector surface, are also included in the graphical solution. Cost considerations are not included. The nomogram has been used to perform trade-off studies that have provided a basis for determining requirements for a single concentrator that could perform satisfactorily with either the selected Stirling or Brayton engine. This activity is summarized to illustrate the usage of the nomogram. Additionally, modeling relations used in developing the nomogram are presented so that the nomogram can be updated to reflect any changes in the performance characteristics of projected components.

49665 **(DOE/JPL—1060-75) Survey of manufacturers of high-performance heat engines adaptable to solar applications.** Stine, W.B. (Jet Propulsion Lab., Pasadena, CA (USA)). 15 Jun 1984. Contract AM04-80AL13137. 38p. (JPL-PUB—84-46). NTIS, PC A03/MF A01; GPO Dep. File Number DE85000322.

This report summarizes the results of an industry survey made during the summer of 1983. The survey was initiated in order to develop an information base on advanced engines that could be used in the solar thermal dish-electric program. Questionnaires inviting responses were sent to 39 companies known to manufacture or integrate externally heated engines. Follow-up telephone communication ensured uniformity of response.

49666 **(DOE/JPL/1060—76) Experimental and theoretical study of a solar thermochemical receiver module.** Won, Y.S.; Voecks, G.E.; McCrary, J.H. (Jet Propulsion Lab., Pasadena, CA (USA)). 15 Jul 1984. Contract AM04-80AL13137. 34p. (JPL-PUB—84-53). NTIS, PC A03/MF A01; GPO Dep. File Number DE85000352.

A few years ago, a prototype test module of a solar thermochemical receiver using an SO_3/SO_2 reaction system was designed, built, and tested to establish a technical data base for future subsystem design efforts. Emphasis was placed on experimental verification of the computer simulation to establish a reliable design tool to predict the thermochemical performance of the receiver with a reasonable degree of confidence. The computational results were compared with experimental results obtained from the module tested at New Mexico State University. Reasonable agreement was found over a range of test conditions. It was concluded that the present design offers satisfactory conversion performance and operational flexibility for the construction of a complete reactor/receiver unit for use in a 10- to 15-kW dish collector system.

49667 **(DOE/SF/10501—017) Furnish and install control building passenger elevator, Solar One Generating Station. Specification 40-0105.** (Southern California Edison Co., Rosemead (USA)). 11 Jun 1980. Contract FC03-77SF10501. 39p. (STMPO—494). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85001374.

General terms and conditions, supplemental requirements, and technical requirements for furnishing and installing the control building passenger elevator for Solar One Generating Station are given in this specification.

49668 **(DOE/SF/10501—019) Specification for Information Center, Solar One Generating Station. Addendum No. 1.** (Southern California Edison Co., Rosemead (USA)). 16 Apr 1979. Contract FC03-77SF10501. 182p. (STMPO—496). NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE85001375.

This specification is intended to cover all work required to construct an Information Center at the Solar One Generating Station. It includes overall work requirements, sitework, concrete metals, wood and plastics, thermal and moisture protection, doors and windows, finishes, specialities, and special construction.

49669 **(DOE/SF/10501—059) Solar One Generating Station, Daggett, California: Start-up and Test Program Manual.** (Southern California Edison Co., Rosemead (USA)). 1981. Contract FC03-77SF10501. 125p. (STMPO—536). NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85001370.

The purpose of this Start-up Manual is to provide the guidelines and start-up plans for the Solar One Generating Station. The manual includes the functions and responsibilities of the participating organizations, and has been approved by the management of Southern California Edison Company (SCE), the US Department of Energy (DOE) and the other participating organizations. The purpose of the Start-up and Test Program is to provide planned and systematic methods and procedures to conduct the overall startup integration of the Solar One Generating Station Systems. The Start-up and Test Program will include all testing activities beginning at the completion of construction and ending with all systems and equipment fully operational and released to SCE Steam Generation Division.

49670 **(DOE/SF/10501—060) Solar One turbine-generator, turbine 197845 start-up checklist.** Anderson, L.D. (General Electric Co., El Monte, CA (USA)). 14 Jun 1982. Contract FC03-77SF10501. 39p. (STMPO—538). NTIS MF A01; 2; GPO Dep. File Number DE85001380.

The Solar One turbine-generator start-up checklist includes the following: turbine supervisory instrumentation, turbine lube oil system, turbine hydraulic fluid system, steam seal system, turbine control systems, generator system checks, turbine performance data, and fine mesh screen removal.

49671 **(DOE/SF/10501—063) 10-MWe solar thermal central receiver pilot plant operational test management plan. Three year power production phase effective August 1, 1984.** (Southern California Edison Co., Rosemead (USA)). 17 Jul 1984. Contract FC03-77SF10501. 21p. (STMPO—964). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017040.

The Operational Test Management Plan describes the procedures and responsibilities for managing the Plant's operation during the five-year Operational Testing period. The Plan defines the management structure and specifies the responsibilities for developing test procedures and safe operating procedures, and for plant performance evaluation. Budgeting responsibilities and data generation and distribution procedures are also described.

49672 **(SAND—84-8175) Molten salt steam generator subsystem research experiment: executive summary. Phase 1, final report.** (Babcock and Wilcox Co., Barberton, OH (USA)). Sep 1984. Contract AC04-76DR00789. 27p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85000246.

This is the Executive Summary of a study conducted for Phase 1 of a two-phase project whose objectives were to develop a

reliable, cost-effective molten salt steam generating subsystem for solar thermal plants, minimize uncertainty in capital, operating, and maintenance costs, and demonstrate the ability of molten salt to generate high-pressure, high-temperature steam. The Phase 1 study involved the conceptual design of molten salt steam generating subsystems for a nominal 100-MWe net stand-alone solar central receiver electric generating plant, and a nominal 100-MWe net hybrid fossil-fueled electric power generating plant that is 50% repowered by a solar central receiver system. As part of Phase 1, a proposal was prepared for Phase 2, which involves the design, construction, testing and evaluation of a Subsystem Research Experiment of sufficient size to ensure successful operation of the full-size subsystem designed in Phase 1. Evaluation of several concepts resulted in the selection of a four-component (preheater, evaporator, superheater, reheater), natural circulation, vertically oriented, shell and tube (straight) heat exchanger arrangement. Thermal hydraulic analysis of the system included full and part load performance, circulation requirements, stability, and critical heat flux analysis. Flow-induced tube vibration, tube buckling, fatigue evaluation of tubesheet junctions, steady-state tubesheet analysis, and a simplified transient analysis were included in the structural analysis of the system. Operating modes and system dynamic response to load changes were identified. Auxiliary equipment, fabrication, erection, and maintenance requirements were also defined. Installed capital costs and a project schedule were prepared for each design. The complete Phase 1 final report has been published as SAND 82-8179.

49673 **(SAND—84-8177) Molten salt steam generator subsystem research experiment: executive summary. Phase I. Specification and preliminary design. Final report.** (Babcock and Wilcox Co., Barberton, OH (USA). Nuclear Equipment Div.; Babcock and Wilcox Co., Alliance, OH (USA). Contract Research Div.). Sep 1984. Contract AC04-76DR00789. 26p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002090.

This is the executive summary for a study in which steam generator subsystem and component designs were developed for central receiver solar power applications using molten nitrate salt as the primary heat transfer medium. Designs were established for a 100 MWe stand-alone plant and for a 100 MWe fossil-fueled plant which has been 50% repowered by solar energy. In the course of this program, (1) an optimum steam system arrangement was selected for both the stand-alone and repowering applications; (2) cost-effective heat exchanger designs (preheater, evaporator, superheater, and reheater) were established based on conventional fabrication processes; (3) comprehensive subsystem and component specifications were prepared; (4) a control system was designed and characterized, and the system response to selected upset transients was simulated; (5) shop fabrication and field erection plans, schedules, and cost estimates were developed; and (6) development plans intended to resolve design uncertainties and assure user confidence and acceptance were prepared. The complete Phase I final report has been published as SAND 82-8177.

49674 **(SAND—84-8178) Molten salt receiver subsystem research experiment: executive summary. Phase I, final report.** (Babcock and Wilcox Co., Barberton, OH (USA). Nuclear Equipment Div.). Sep 1984. Contract AC04-76DR00789. 37p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85001589.

This is the executive summary for a report which presents the preliminary design of a molten salt receiver subsystem for application to solar thermal central receiver power plants. The design is applicable to a repowered utility electric plant or to a stand-alone plant. The receiver subsystem consists of an elevated quad-cavity receiver, a concrete tower to support the receiver, riser and downcomer piping within the tower to transport the salt to and from the thermal storage sub-system, heat absorption panels within the receiver cavities to absorb the incident radiant energy, and the pumps, tanks, piping systems, valves, controls and instrumentation necessary to provide safe and efficient operation of the receiver subsystem. Incident radiant energy is concentrated on the receiver cavity openings by a surround heliostat field. The design is based on a 320 MWt receiver sited at Barstow, California. The report provides the design requirements necessary to detail the design of the receiver subsystem, a detailed description of the subsystem components, and the design methods employed to produce the design. A development plan highlights the areas of technical uncertainty along with the required development effort to resolve these uncertainties. Manufacturing processes were developed to establish the fabricability of the heat absorption panels. The cost and schedule from design through start up for the receiver subsystem are also provided. The complete Phase I final report has been published as SAND 82-8178.

49675 **Operation and control of a solar molten salt steam generating system.** Ahluwalia, K.S.; Goidich, S.J.; Gupta, G.D.; Raghavan, R. (Foster Wheeler Development Co., Livingston, NJ). pp 124-130 of Solar Engineering -- 1984. Yogi Goswami, D. New York, NY, USA; A.S.M.E. (1984). (CONF-840402—).

From 6. annual ASME Solar Energy Division technical conference; Las Vegas, NV, USA (10 Apr 1984).

The unique thermal properties of molten salt make it an excellent candidate for use in solar power plants requiring large amounts of thermal storage. Throughout the years, molten salt has been used as a heat-transfer medium in many process applications, but never has it been properly evaluated as a medium for generating high-pressure, high-temperature steam in a solar thermal power plant. The high freezing point of molten salt and other constraints for its use mandate careful selection of operating modes and control schemes for the solar-powered molten salt steam generating system. This paper identifies these unique constraints and describes the control schemes that allow safe and reliable operation of a molten salt 100-MWe stand-alone steam generator system.

49676 **Small Brayton central receiver systems for remote industrial power generation.** Beverly, W.D. (Boeing Eng. Company, Seattle, WA). pp 47-56 of Solar Engineering – 1984. Yogi Goswami, D. New York, NY, USA; A.S.M.E. (1984). (CONF-840402—).

From 6. annual ASME Solar Energy Division technical conference; Las Vegas, NV, USA (10 Apr 1984).

This study investigated the potential of small-scale, central receiver Brayton cycle systems to provide simple, highly-reliable, low-maintenance electrical generating systems. The study objectives were to identify Brayton cycle configurations suited for high-reliability central receiver systems generating electricity in the 2 and 25 MW(e) power ranges and to identify and recommend high-temperature receiver designs most appropriate to the preferred cycle configurations. At the 2 MW(e) size, an open simple cycle was chosen because of its low capital and energy costs, reduced complexity, and turbomachinery availability. An open cycle regenerated and intercooled configuration was selected for the 25 MW(e) plant size because of its high cycle efficiency, reduced heliostat field costs, reduced capital and energy costs, and turbomachinery availability. A small-carbon-particle receiver concept was selected for the 2 MW(e) plant size. This concept has superior performance and cost and reasonable reliability, maintainability and operability. A ceramic tube receiver concept was selected as the preferred concept for the 25 MW(e) plant size. This concept has reasonable performance and cost through the use of a simple, straightforward design. The results of this study show that small-scale, remotely-sited solar Brayton central receiver systems are technically feasible and economically attractive through the use of simple, passive receiver designs. Relatively straightforward development will be required to implement these solar central receiver designs.

49677 **Development and evaluation of the Texas Instruments Solar Energy System.** Mckee, W.R.; Carson, K.R.; Levine, J.D. (Texas Instruments, Inc., Dallas, TX). pp 257-262 of Photovoltaic specialists conference. New York, NY, USA; Institute of Electrical and Electronics Engineers (1982). (CONF-820906—). Contract FC01-79ER10000.

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

The Texas Instruments Solar Energy System (TISES) is a unique solar energy conversion and storage system with many potential cost advantages over other approaches now being considered. The individual photovoltaic elements are tiny silicon spheres which are packed into thin glass sheets and then immersed in an HBr electrolyte where they perform an electrolysis function. The system provides for storage of the reaction products and then re-

combination in a fuel cell to produce an electrical output. The development status of the various system components will be presented. Plans for outdoor testing of a complete, functional prototype unit will also be discussed. 5 references.

1408 Ocean Energy Systems

49678 (DOE/SF/10501—004) Solar One. (Southern California Edison Co., Rosemead (USA)). 1981. Contract FC03-77SF10501. 9p. (STMPO—040). NTIS, PC A02/MF A01; GPO Dep. File Number DE84017036.

This brochure briefly describes the Solar One central receiver solar thermal power plant and gives diagrams depicting how the system works.

49679 An artificial upwelling driven by salinity differences in the ocean. Johnson, D.H.; Decicco, J. (Solar Energy Research Inst., Golden, CO). pp 314-320 of ASME energy sources technology conference and exhibition. Vol. 2. New York, NY, USA; A.S.M.E. (1984). (CONF-840201—).

From ASME energy sources technology conference and exhibition; New Orleans, LA, USA (12 Feb 1984).

A concept for an artificial upwelling driven by salinity differences in the ocean to supply nutrients to a mariculture farm is described and analyzed. A long shell-and-tube counterflow heat exchanger built of inexpensive plastic and concrete is suspended vertically in the ocean. Cold, nutrient rich, but relatively fresh water from deep in the ocean flows up the shell side of the heat exchanger, and warm but relatively saline water from the surface flows down the tube side. The two flows exchange heat across the thin plastic walls of the tubes, maintaining a constant temperature difference along the heat exchanger. The plastic tubes are protected by the concrete outer shell of the heat exchanger. The flow is maintained by the difference in density between the deep and surface water due to their difference in salinity. This phenomenon was first recognized by the oceanographer Stommel, who termed it "The Perpetual Salt Fountain." The heat transfer and flow rate as a function of tube number and diameter is analyzed and the size of the heat exchanger optimized for cost is determined for a given flow of nutrients for various locations. Reasonable sizes (outer diameter on the order of 5 m) are obtained. The incremental capital cost of the salinity-driven artificial upwelling is compared to the incremental capital cost and present value of the operating cost of an artificial upwell fueled by liquid hydrocarbons. The salinity-driven upwelling is generally cheaper.

49680 OTEC pilot plant for Kahe Point, Hawaii. Hoffman, B.; Griffin, A.B. (Ocean Thermal Corp., New York, NY). pp 159-166 of ASME energy sources technology conference and exhibition. Vol. 2. New York, NY, USA; A.S.M.E. (1984). (CONF-840201—).

From ASME energy sources technology conference and exhibition; New Orleans, LA, USA (12 Feb 1984).

Under contract to the U.S. Department of Energy, a team led by Ocean Thermal Corporation (OTC) and its systems integration contractor, TRW, is developing a design of a closed-cycle OTEC pilot power plant to be located at Kahe Point, Oahu, Hawaii. This site was chosen because of the availability of 41 degrees F cold water within three miles of the proposed plant location and warm discharge water from six Hawaiian Electric Company (HECO) power units which is used to enhance the 38 degree F temperature difference available in the ocean waters. The facility will be bottom-mounted just offshore and will have four 10 MWe modules each consisting of two evaporators, two condensers and a turbine. The power system will be housed in a concrete "land-based containment system", and cold water will be supplied to the plant by a pipe constructed of concrete, steel, and fiberglass reinforced plastic (FRP) extending seaward two and one half miles to a depth of 2500 feet.

49681 Design of the near shore seawater systems for an OTEC expanded test facility. Genens, L.; Stevens, H. (Argonne National Laboratory, Argonne, IL). pp 141-144 of ASME energy sources technology conference and exhibition. Vol. 2. New York, NY, USA; A.S.M.E. (1984). (CONF-840201—).

From ASME energy sources technology conference and exhibition; New Orleans, LA, USA (12 Feb 1984).

Argonne National Laboratory (ANL) is preparing a design for expanded test facilities at the Seacoast Test Facility site, Keahole Point, Hawaii. Specific effort has been placed on the design of the nearshore/on-shore seawater systems. The seawater systems consist of a warm-water supply, a cold-water supply, a mixed discharge, and a land-based pumping station. Test facilities are planned that will utilize this thermal energy resource. This resource consists nominally of 1600 kg/s (25,000 gpm) of cold water and 4200 kg/s (65,000 gpm) of warm surface water, which will be used to support heat-exchanger and system tests and, with a turbine added, could produce a net power for the validation of closed- and open-cycle models now in planning at ANL and the Solar Energy Research Institute (SERI). The design of this facility is an upgraded outgrowth of earlier work done for the state of Hawaii supported by DOE funds in 1978. The experimental needs have changed significantly; first the system capacity was increased sixfold and second required the use of submerged warm and cold water piping and pumps to supply the barometric leg used for open cycle experiments as well as prototypical water supplies for closed cycle tests. Another change gained from experience onsite was to locate the pumping facilities on-shore free of the influence of storms or high surf.

1409 Solar Thermal Utilization

REFER ALSO TO CITATION(S) 14090049601, 49719, 49720

49682 (BMFT-FB-T—84-089) Drying grapes with solar energy. Eissen, W. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jun 1984. 142p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE84752106.

Mass losses and low quality are the most serious disadvantages of traditional grape drying methods. For the production of high quality raisins an increase of the drying rate is required and the grapes should be protected from rain, dust and insects during drying. In the framework of a Greek-German research program low cost solar grape dryers were developed in the Institute of Agricultural Engineering at Hohenheim University and were tested in Greece in cooperation with the crete Agricultural Research Center. The required data basis for optimizing solar grape dryers was obtained by additional laboratory tests measuring the influence of various drying parameters on the drying rate and quality. The solar drying tests have shown that it is possible to reduce the drying time and improve the quality significantly compared to the traditional drying methods. Mass losses due to rain can be prevented. The solar dryers can be constructed by the farmers themselves or by craftsmen using locally available materials and simple tools.

49683 (CONF-840954—6) Hybrid system for producing and storing ice. Francis, C.E.; Larash, R.C.; Gorski, A.J. (Illinois State Univ., Normal (USA); Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017474.

From 9. national passive solar conference; Columbus, OH, USA (23 Sep 1984).

Refrigeration, cooling and/or chilling methods usually require rather large amounts of energy for operation. This system uses naturally frozen ice in long-term storage to provide an economical source of ice for various cooling or chilling purposes. Initial research and computer simulations indicate that in areas where the winter is sufficiently cold and of sufficient duration, this system would be an economical, viable option for uses such as simple refrigeration, summer air conditioning, or simply for effective dehumidification. In a 36 day melting period in June and July 1984, the system ran nearly continuously for 768 hours, recovering a total of 743 tons of cooling with an estimated 5 to 8% of the stored cooling

capacity remaining. The seasonal melting loss was approximately 50% of the stored capacity.

49684 **(DOE/CS/30012—T1) Solar energy industry survey.** (DHR, Inc., Washington, DC (USA); R and L Associates, San Jose, CA (USA)). 6 Aug 1979. Contract AC01-79CS30012. 68p. NTIS, PC A04/MF A01; GPO Dep. File Number DE84017265.

This report describes the results of a survey of companies in the solar energy industry. The general objective of the survey was to provide information to help evaluate the effectiveness of technology transfer mechanisms for the development of the solar industry. The specific objectives of the survey included: (1) determination of the needs of the solar industry; (2) identification of special concerns of the solar industry; and (3) determination of the types of technology transfer mechanisms that would be most helpful to the solar industry in addressing these needs and concerns. The major focus was on technical problems and developments, but institutional and marketing considerations were also treated. The majority of the sample was devoted to the solar heating and cooling (SHAC) component of the industry. However, a small number of photovoltaic (PV), wind, and power generation system manufacturers were also surveyed. Part I discusses the methodology used in the selection, performance, and data reduction stages of the survey, comments on the nature of the responses, and describes the conclusions drawn from the survey. The latter include both general conclusions concerning the entire solar industry, and specific conclusions concerning component groups, such as manufacturers, architects, installers, or dealers. Part II consists of tabulated responses and non-attributed verbatim comments that summarize and illustrate the survey results.

49685 **(DOE/ET/20643—T4) Fabrication, testing, installation, and start-up of a 53 kW solar absorption cooling system.** (Carrier Corp., Syracuse, NY (USA). Energy Systems Div.). 1983. Contract FC02-80ET20643. 85p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85001611.

Fabrication, testing, installation, start-up, and as-built drawings of a nominal 53 kW solar absorption cooling system installed at the Carrier Corporation, Phoenix, Arizona are reported. Also included are laboratory test data, reduced data and the corresponding printout from the Kaye data recorder for three runs at design condensing temperature, chilled water and several hot water temperatures.

49686 **(EPRI-EM—3676) Assessment of how residential passive solar systems impact utilities. Final report.** Neal, R.W.; Wood, R.A.; McCabe, T.F. (JBF Scientific Corp., Wilmington, MA (USA)). Sep 1984. 218p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920009.

This report describes a project undertaken to provide the electric utility industry with a tool to use in analyzing the advantages and disadvantages, for themselves and their customers, of passive solar residential construction within their service areas. A methodology to accomplish this was created and then tested in cooperation with seven utilities. The results show that passive solar design and system performance are extremely site-specific and utility-specific. As a result, it is not possible to generalize findings such that they would be applicable or typical for all utilities. However, findings do indicate that both well-insulated (energy conserving) homes and passive solar homes perform better in terms of minimizing the total cost of energy needed for heating and cooling than do conventional homes. Further indications are that passive solar homes tend to have lower life-cycle costs for heating and cooling than well-insulated homes where: (1) the annual heating load predominates over the annual cooling load; and (2) there is an adequate amount of sunshine during the heating season. Where neither condition is met, well-insulated homes tend to have lower life-cycle costs.

49687 **(NMERDI—2-67-1135/11) Southwest thermal mass study, Tesuque Pueblo, New Mexico. Observation and prediction of the heating season thermal mass effect for eight test buildings with and without windows. Research Phase II, January 1983-June 1983.** Robertson, D.K. (New Mexico Univ., Albuquerque (USA). New Mexico Energy Research and Development Inst.). Sep 1984. Contract AC05-84OR21400. 77p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85002049.

Eight one-room test buildings, 6.1 m square and 2.3 m high inside, were constructed on a high desert site near Tesuque Pueblo, New Mexico, to study the influence of wall dynamic heat transfer characteristics on building heating energy requirements (such influence is sometimes called the thermal mass effect). The buildings are nominally identical except for the walls, and are instrumented to record building component temperatures and heat fluxes; indoor temperature, humidity, globe temperature, and interior surface temperatures; and outdoor weather, solar data, and ground temperatures. This report presents the results from analysis of heating season data for one-and-a-half heating seasons. For the first heating season, the buildings were windowless; for the last half, windows were added to most of the buildings, and insulation was added to one massive building. The simplified analysis methodology developed in an earlier technical report, consisting of comparisons of each building's energy use with that of a massive, windowless reference building, was utilized. It was found, as before, that deviations from proportionality to the massive building (energy use in excess of steady-state predictions using average weather data) result from increased average interior temperature during those days when heating is required for part of the day. Specifically, it was found that the following increased the percentage effect: lack of envelope thermal mass, increased solar gain to the interior, and increased wall R-value. The maximum observed effect was 5.3% +- 2% excess energy use in the most lightweight building. A method was developed to evaluate the effect for any set of weather conditions (with insolation levels similar to New Mexico). It was found that the percentage effect varied significantly with location in New Mexico and with the year of the heating season. The maximum calculated effect, for the lightest building in the mildest climate, was greater than 12%.

49688 **(PB—84-202001) Solar shading of windows: a simple photographic analysis.** McIntyre, D.A. (Electricity Council Research Centre, Capenhurst (UK)). Feb 1984. 39p. (ECRC/M—1773). NTIS, PC E04/MF E04.

Solar gains through windows provide an important contribution to the space heating of a house. However, nearby obstructions may produce considerable shading. This is likely to be greatest in winter when the sun is low in the sky, but when the heat is most needed. This Memorandum describes a technique for the measurement of solar shading in existing houses. Photographs are taken out of each window, using a camera fitted with a wide angle lens. Sun path diagrams are then sketched on photographic prints, using a programmable calculator to calculate solar positions. In this way, times of appearance and disappearance of the sun can be very rapidly estimated, and compared with the maximum possible sunshine duration that would exist in the absence of any obstructions.

49689 **(PB—84-203348) Evaluation of thermal energy conservation schemes for an experimental masonry building. Final report.** Gujral, P.S.; Clark, R.J.; Burch, D.M. (National Bureau of Standards, Washington, DC (USA). Center for Building Technology). Jul 1982. 43p. (NBS-BSS—137). NTIS, PC A03/MF A01.

Library of Congress catalog card No. 81-600175. Prepared in cooperation with Skidmore, Owings and Merrill, Chicago, IL and King Abdulaziz Univ., Jeddah (Saudi Arabia). Color illustrations reproduced in black and white.

A one-room masonry building with exterior polystyrene rigid board insulation was built within a large environmental chamber at the National Bureau of Standards. Various climatic conditions were simulated within the chamber, and the transient thermal response of the test building was monitored. Three schemes (night cooling using a ceiling-mounted valance cooling coil, natural ventilation night cooling, and passive solar heating) were investigated with regard to energy conservation. The test results indicated that

these operating practices resulted in a considerable reduction in energy consumption for space heating and cooling. The measured performance of the test building compared favorably with the corresponding performance obtained with an analytic model.

49690 **(SERI/SP—253-2373) Specification and cost manual for energy retrofits on small commercial and multifamily buildings.** Bircher, C.; Carlisle, N.; Hunter, K.; MacDonald, M.; Shapira, H.; Vineyard, T.A.; Kolb, J. (Solar Energy Research Inst., Golden, CO (USA); Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC02-83CH10093;AC05-84OR21400. 140p. NTIS, PC A07/MF A01; GPO Dep. File Number DE84012753.

This specification/cost manual was prepared as part of DOE's technical assistance to the states, utilities and other groups participating in the Commercial and Apartment Conservation Service (CACS) program. The intention is to provide a set of standardized specifications and cost information for the CACS program measures. The material was designed to be used primarily by contractors and others in preparing cost estimates at the request of CACS utilities. This information can also be used by CACS participants in preparing state plans, analyzing which measures are best-suited for their particular climates, computing paybacks, and carrying out audits. In addition, this publication may be of interest to the wider audience involved in the energy retrofit field, ranging from architects and engineers to energy auditors and building inspectors. Each specification contains several categories of information: title; description; recommendations; materials; installation; maintenance; cost information; material cost variables, installation cost variables, regional variables, and safety/hazard issues. The document is divided into six sections: building envelope and service insulation measures; HVAC measures: simple systems; HVAC measures: complex systems; lighting system measures; active solar system measures; and passive solar system measures.

49691 **(SOLAR/0011—84/01) Solar energy system case study: Telex Communications, Blue Earth, Minnesota.** Raymond, M.G. (Vitro Corp., Silver Spring, MD (USA)). Sep 1984. Contract AC01-79CS30027. 204p. NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE85002140.

A study is made of a solar energy system for space heating a 97,000-square-foot office, factory, and warehouse building owned by Telex Communications, Inc. in Blue Earth, Minnesota. The solar system has 11,520 square feet of ground-oriented flat-plate collectors and a 20,000-gallon storage tank inside the building. Freeze protection is by drainback. Solar heated water from the storage tank circulates around the clock throughout the heating season to heating coils in the ducts. The system achieves its design solar fraction, is efficient, and generally reliable, but not cost-effective. Performance data for the solar system was collected by the National Solar Data Network for three heating seasons from 1978 to 1981. Because of a freeze-up of the collector array in December 1978, the solar system was only partially operational in the 1978 to 1979 heating season. The data in this report were collected in the 1979 to 1980 and 1980 to 1981 heating seasons.

49692 **(SOLAR/0013—84/30) Survey of remote data monitoring systems.** Logee, T.L.; Kendall, P.W.; Pollock, E.O.; Raymond, M.G.; Knapp, R.C. Jr. (Vitro Corp., Silver Spring, MD (USA)). Sep 1984. Contract AC01-79CS30027. 63p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85001385.

A self-contained data-logger device called an SDAS (Site Data Acquisition Subsystem) was built for the National Solar Data Network (NSDN) which could collect analog data from 96 channels, store the data for up to three days, and then transmit the stored data on request to a central facility by voice-grade telephone lines. This system has worked fairly well for the eight years that it has been in service. However, the design and components are getting old and newer dataloggers may be more reliable and accurate and less expensive. This report discusses the results of an extensive search for an SDAS replacement. The survey covered 62 models from 36 manufacturers. These numbers are not indicative of all the dataloggers or manufacturers available, but only those which appeared to have some qualifications for the NSDN datalogger replacement. This report views the datalogger as a system which is made up of sensors, a data acquisition and storage unit, a telecommunications subsystem, and a data processing subsystem. Therefore, there is a section on sensors used in the NSDN, telecommunications technology, and data processing requirements. These four components or subsystems are all necessary in order to have an integrated, successful remote data monitoring network.

49693 **(SOLAR/0015—84/32) Component report performance of solar collector arrays and collector controllers in the National Solar Data Network.** Logee, T.L.; Kendall, P.W. (Vitro Labs., Silver Spring, MD (USA)). Jul 1984. Contract AC01-79CS30027. 242p. NTIS, PC A11/MF A01; 1; GPO Dep. File Number DE85001297.

The accumulated National Solar Data Network (NSDN) data has been analyzed with regard to collector and collector control performance. The collector data is presented in the ASHRAE format as efficiency vs. operating point, (T/sub inlet/ - T/sub ambient/)/insolation. Collector controls were analyzed by determining the losses caused by control problems common to the NSDN solar systems. This study of collectors and collector controls has several objectives: To compare actual and predicted collector performance; to determine which generic types of components performed well and which performed poorly; to determine why predicted performance was not achieved in the field; to determine the types and causes of failures; to determine the reliability weaknesses; and to determine whether there are any component integration problems. To accomplish these objectives, the work was divided into two parts, the first part was dedicated to the collector component and the second part covered the control component. The report is organized similarly, and also includes a description of each solar system (Appendix A) and a discussion of the interactions between the components.

49694 **(SOLAR/0802—84/01) Actual versus design performance of solar systems in the National Solar Data Network.** Logee, T.L.; Kendall, P.W. (Vitro Labs., Silver Spring, MD (USA)). Sep 1984. Contract AC01-79CS30027. 131p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE85001190.

This report relates field measured performance to the designer predicted performance. The field measured data was collected by the National Solar Data Network (NSDN) over a period of six years. Data from 25 solar systems was selected from a data pool of some 170 solar systems. The scope of the project extends beyond merely presenting comparisons of data. There is an attempt to provide answers which will move the solar industry forward. As a result of some industry and research workshops, several concerns arose which can be partially allayed by careful study of the NSDN data. These are: What types of failures occurred and why? How good was the design versus actual performance? Why was predicted performance not achieved in the field? Which components should be integrated with a system type for good performance? Since the designs span several years and since design philosophies are quite variable, the measured results were also compared to f-Chart 5.1 results. This comparison is a type of normalization in that all systems are modeled with the same process. An added benefit of this normalization is a further validation of the f-Chart model on a fairly large scale. The systems were modeled using equipment design parameters, measured loads, and f-Chart weather data from nearby cities.

49695 **(SOLAR/1024—79/10) Living Systems. Monthly performance report.** (Automated Industries, Inc., Silver Spring, MD (USA)). Oct 1979. Contract AC01-79CS30027. 22p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017361.

The Living Systems site is a single-family residence in Davis, California. The home has approximately 1700 square feet of conditioned space. The solar energy system consists of two independently-controlled systems: an active system for preheating domestic hot water (DHW) and passive system for space heating the home. The active solar DHW system has an array of flat-plate collectors with a gross area of 46 square feet. The passive solar space heating system is of the direct-gain type. Incident solar energy is admitted to the building through both the large south-facing vertical win-

dows (approximately 200 square feet) and the overhead skylight (approximately 80 square feet with a tilt of 60 degrees to the horizontal. Performance results are presented for each of the systems.

49696 **(WAOENG—84-42) Solar collection.** Cole, S.L. (Washington State Energy Office, Olympia (USA)). Aug 1984. 48p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85000060.

This report contains summaries and pictures of projects funded by the Appropriate Technology Small Grants Program which include the following solar technologies: solar dish; photovoltaics; passive solar building and solar hot water system; Trombe wall; hot air panel; hybrid solar heating system; solar grain dryer; solar greenhouse; solar hot water workshops; and solar workshops.

49697 **Solar heated rotary kiln.** Shell, P.K. (to Dept. of Energy). US Patent 4,443,186. 17 Apr 1984. Filed date 14 Apr 1982. vp.

PAT-APPL-368198.

A solar heated rotary kiln utilized for decomposition of materials, such as zinc sulfate. The rotary kiln has an open end and is enclosed in a sealed container having a window positioned for directing solar energy into the open end of the kiln. The material to be decomposed is directed through the container into the kiln by a feed tube. The container is also provided with an outlet for exhaust gases and an outlet for spent solids, and rests on a tiltable base. The window may be cooled and kept clear of debris by coolant gases.

49698 **Characterization of representative air and liquid-type collectors for solar economic analysis in residences.** Zehr, F.J.; O'Neal, D.L. (Westminster College, New Wilmington, Pennsylvania). pp 339-345 of Solar Engineering -- 1984. Yogi Goswami, D. New York, NY, USA; A.S.M.E. (1984). (CONF-840402—).

From 6. annual ASME Solar Energy Division technical conference; Las Vegas, NV, USA (10 Apr 1984).

Through the years, a number of studies have evaluated the economics of residential solar space and water heating systems. Usually a "typical" system was arbitrarily chosen and the analysis performed. Unless care was taken in the choice of the "typical" system, the results could be biased either for or against the use of solar energy. The purpose of this study was to develop accurate representative performance and cost data for s used in residential solar applications. A survey of the available stock of collectors was done from product guides, manufacturers' literature, and individual telephone inquiries. The following data was collected for each collector: F /SUB R/ (/tau/α), F /SUB R/ U /SUB L/ , recommended coolant flowrate, and collector cost. The survey included six air-single, eight air-double, forty-two liquid single, and seventeen liquid-double glazed collectors. Collector performance was determined by evaluating the solar fraction a system would provide for a residence in Kansas City with collectors sized at 10, 20, 30, 40, 60, 80 and 100 m^2. The residence was average in floor area (156 m^2), featuring energy conserving house design. F-CHART was used to calculate all solar fractions. Manufacturers recommended flowrates were used in all calculations. Storage system capacity and heat exchanger effectiveness was 314 kJ/(^oC-m^2) and 0.7, respectively. Plots of solar fraction versus collector cost were developed for each type of collector. The wide variety in cost and performance of collectors is shown in these plots.

49699 **Cycle and system irreversibilities of solar powered absorption cooling.** Anand, D.K.; Lindler, K.W.; Schweitzer, S. (TPI, Inc., University of Maryland, Princess Anne, Maryland). pp 302-307 of Solar Engineering -- 1984. Yogi Goswami, D. New York, NY, USA; A.S.M.E. (1984). (CONF-840402—).

From 6. annual ASME Solar Energy Division technical conference; Las Vegas, NV, USA (10 Apr 1984).

Solar powered absorption cooling cycles and systems are analyzed via the Second-Law of Thermodynamics. Irreversibility is used as a figure of merit for components and cycles. The irreversibility of individual components is determined for several solar powered absorption cycles and systems. The understanding of the causes of these irreversibilities pinpoints the areas of possible cycle and system improvements.

49700 **Modeling of solid-side mass transfer in desiccant particle beds.** Pesaran, A.A.; Mills, A.F. (Solar Energy Research Inst., Golden, CO). pp 177-185 of Solar Engineering -- 1984. Yogi Goswami, D. New York, NY, USA; A.S.M.E. (1984). (CONF-840402—).

From 6. annual ASME Solar Energy Division technical conference; Las Vegas, NV, USA (10 Apr 1984).

A model is proposed for heat and mass transfer in a packed bed of desiccant particles and accounts for both Knudsen and surface diffusion within the particles. Using the model, predictions are made for the response of thin beds of silica gel particles to a step change in air inlet conditions and compared to experimental results. The predictions are found to be satisfactory and, in general, superior to those of pseudogas-side controlled models commonly used for the design of desiccant dehumidifiers for solar air conditioning application.

49701 **Testing and computer simulation of an air based, solar assisted heat pump system.** Hawken, P.; Karaki, S. (Solar Energy Applications Laboratory, Colorado State University, Fort Collins, Colorado). pp 518-523 of Solar Engineering -- 1984. Yogi Goswami, D. New York, NY, USA; A.S.M.E. (1984). (CONF-840402—).

From 6. annual ASME Solar Energy Division technical conference; Las Vegas, NV, USA (10 Apr 1984).

A detailed performance measurement and computer simulation of an air-heating solar system with series configured heat pump auxiliary was undertaken for Solar House 2 at Colorado State University. This paper describes the development of a TRNSYS based system simulation model and the validation of that model. The results of this study show that unless air leakage at the collector array, thermal capacitance and the effects of flow rate are included in the simulation model, comparisons with measurements are poor. Hence, the results obtained from simulation models of air heating systems that do not include these effects properly may not be representative of real system performance.

49702 **Passive solar homes.** McPhillips, M.; Powell, P.C. (eds.). New York, NY; Facts on File Inc. (1982). 287p. (DOE/NBM—4006805). Facts on File Inc., 460 Park Ave., New York, NY 10016. File Number TI84006805.

The concept of passive solar energy is described; the various functions which passive solar systems must perform are explained; and the various types of passive systems found in the Cycle 5 projects are discussed. Each of 91 solar home designs are discussed and some of the key points raised in the discussion of passive solar concepts are indicated in these descriptions and on the illustrations. Additional detail on issues of climate requirements and site design concerns, examples of building construction details showing good practice, and suggestions on how to market solar homes are included. The appendices address more technical aspects of the design and evaluation of passive solar homes, and provide information on other resources available to those involved in passive solar housing. (MHR)

1410 Solar Collectors And Concentrators

REFER ALSO TO CITATION(S) 14100049620, 49631, 49663, 49693, 50214

49703 **(BMFT-FB-T—84-164) Fluorescent dyes for luminescent solar concentrators. Final report.** Iden, R.; Seybold, G.; Stange, A.; Eilingsfeld, H. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); BASF A.G., Ludwigshafen am Rhein (Germany, F.R.)). Aug 1984. 115p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE85750066.

For application in luminescent solar concentrators dyes have been developed, which fulfill in many properties the requirements. Most suitable were perylen dyes and perylimid dyes, boroncomplexes of naphtholactam dyes and polycarbocyclic dyes. These compounds cover the whole colour range from yellow to blue. In the yellow shade a perylimid could be synthesized with an extraordinary longtime stability. A very stable blue dye emits over 650 nm with quantum yield of 92%. Methods for high purification of fluo-

rescent dyes have been worked out which are suited in semitechnical scale.

49704 (DOE/R4/10487—T1) High efficiency parabolic solar collector with glass pipe and black fluid. Roux, J.A.; Chang, M.J. (Mississippi Univ., University (USA)). Oct 1983. Contract FG44-81R410487. 38p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85000377.

Glass pipe and a black fluid were combined with a parabolic solar reflector to produce a high efficiency solar collector. The thermal efficiency of three different types of receivers with a parabolic trough solar reflector were compared: (1) single-layered glass tube with black fluid, (2) double-layered glass tube with black fluid, and (3) black copper tube with clean water. The single-layered glass tube employing a black working fluid performed better than the other types. The efficiency of the single-layered glass tube with black fluid was found to be about 3% better than the black copper tube. The effect of mass flow rate (laminar or turbulent flow) was found to be insignificant. The black fluid solar collector was found to have an optimum efficiency for a blackening agent concentration of about 15 ml per gallon of water. An analytical model was developed to compare with the experimental data by using a lumped heat capacity formulation.

49705 (N—84-22004) JPL tests of a LaJet concentrator facet. Dennison, E.W.; Argoud, M.J. (Jet Propulsion Lab., Pasadena, CA (USA)). Nov 1983. 17p. (NASA-CR—173470; JPL-PUB—83-92). NTIS, PC A02/MF A01.

A LaJet Energy Company (LEC) concentrator facet, 60 in. in diameter, was tested for imaging quality. The following two methods were used: (1) autofocus tests with a point source of light at the facet's radius of curvature and (2) tests with the Sun close to the horizon as a distant source. The tests of the LaJet facet indicate that all of the solar image reflected by an LEC 460 solar concentrator made of like facets should fall within a 9-in. aperture if the outer facets are carefully adjusted. Such a concentrator would have acceptable performance, but complete evaluation must be made with an assembled concentrator.

49706 (N—84-22010) Solar tests of aperture plate materials for solar thermal dish collectors. Jaffe, L.D. (Jet Propulsion Lab., Pasadena, CA (USA)). Aug 1983. 79p. (NASA-CR—173462; JPL—5105-121). NTIS, PC A05/MF A01.

In parabolic dish solar collectors, walk-off of the spot of concentrated sunlight is a hazard if a malfunction causes the concentrator to stop following the Sun. Therefore, a test program was carried out to evaluate the behavior of various ceramics, metals, and polymers under solar irradiation of about 7000 kW/sq m. (peak) for 15 minutes. The only materials that did not slump or shatter were two grades of medium-grain extruded graphite. High purity, slip-cast silica might be satisfactory at somewhat lower flux. Oxidation of the graphite appeared acceptable during tests simulating walk-off, acquisition (2000 cycles on/off Sun), and spillage (continuous on-Sun operation).

49707 (RF—763300/714885) Salt-gradient solar pond development. Final report, September 1, 1982-February 29, 1984. Nielsen, C.E. (Ohio State Univ., Columbus (USA). Dept. of Physics). Aug 1984. Contract AC04-82AL21115. 30p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84007896.

This report describes results of work done from 24 September 1982 to 29 February 1984. This was a continuation of work carried out under a previous grant. The most important new accomplishments were heat extraction amounting to a significant fraction of solar input, demonstration of surface zone control by brine injection, the observation of downward movement of the lower gradient zone boundary as a result of heat extraction, and the recording of quantitative data on the magnitude of wind speed required to cause gradient zone erosion in the 400 m^2 pond. This report includes also a section on foreign solar pond visits made between 20 August and 15 December 1983.

49708 A computer model for stress analysis of spherically curved solar panels. Vallabhan, C.V.G.; Selvam, R.P. (Dept. of Civil Eng., Texas Tech. Univ., Lubbock, TX). pp 131-136 of Solar Engineering -- 1984. Yogi Goswami, D. New York, NY, USA; A.S.M.E. (1984). (CONF-840402—).

From 6. annual ASME Solar Energy Division technical conference; Las Vegas, NV, USA (10 Apr 1984).

Spherically curved solar reflectors consist of a thin glass plate elastically bent to form a spherical surface, glued on to a honeycomb backing, and covered with steel plates at the back and with plastic strips on the sides. Nonlinear Von Karman plate equations are used to analyze the induced stresses in the glass plate as its deflections become large. The analysis consists of evaluation of stresses due to bending and membrane forces during the forming of the spherical surface, along with the calculation of edge moments and the transverse loads due to molds. The interaction of the plate with the honeycomb is analyzed assuming that the plate is resting on an elastic foundation (honeycomb), where the edge moments and the transverse forces calculated earlier are released. The results are compared with other available solutions as well as experimental data.

49709 Technical and cost potential for lightweight, stretched-membrane heliostat technology. Murphy, L.M. (Solar Energy Research Inst., Golden, CO). pp 220-227 of Solar Engineering -- 1984. Yogi Goswami, D. New York, NY, USA; A.S.M.E. (1984). (CONF-840402—).

From 6. annual ASME Solar Energy Division technical conference; Las Vegas, NV, USA (10 Apr 1984).

This paper presents the background and rationale and describes the development effort of a potentially low-cost, concentrating reflector design. The proposed reflector design is called the stretched-membrane concept. In this concept a reflector film-which can be metal, polymeric, or of a composite construction-is stretched on a hollow torroidal frame that offers a structurally efficient and optically accurate surface. Although the intent is to improve heliostat concentrator cost and performance for solar thermal applications, the collector design approach proposed here may well offer effective cost and performance opportunities for improving photovoltaic and solar daylighting applications as well. Some of the major advantages include a reflector, a support frame, and support structures that can be made extremely lightweight and low in cost because of the effective use of material with high average stress levels in the reflector and support frame; a 75% reduction in the weight of the reflector and support structure (down to the drive attachment) over the second-generation glass-and metal heliostat concept; a better than 50% cost reduction for the reflector assembly and support structure compared to corresponding elements of the second-generation concept; and, finally, optical accuracies and an annual energy delivery potential close to those attainable with current glass-and-metal heliostats. In this paper results are presented of initial design studies, performance predictions, and analysis, as well as results corresponding to subscale testing. Also included are recommendations for further development and for resolving remaining issues.

49710 Improvement of the performance of solar energy or waste heat utilization systems by using phase-change slurry as an enhanced heat-transfer/storage fluid. Kasza, K.E.; Chen, M.M. (Argonne National Laboratory, Argonne, IL). pp 166-176 of Solar Engineering -- 1984. Yogi Goswami, D. New York, NY, USA; A.S.M.E. (1984). (CONF-840402—).

From 6. annual ASME Solar Energy Division technical conference; Las Vegas, NV, USA (10 Apr 1984).

This paper is concerned with the benefits of using phase-change slurries as enhanced heat transfer/storage working fluids in solar energy and waste heat utilization systems. Literature is cited to show that a slurry containing a phase-change material as the dispersed phase promises to have much higher heat-transfer coefficients than conventional single-phase working fluids. Because of the latent heat, the phase-change slurry also requires lower pumping rates and smaller storage tanks than single-phase fluids for the same energy content. These benefits are documented by comparisons of temperature drops, pumping rates, pumping powers, and the sizes of storage tanks for a generic energy collection system operating with and without a slurry.

49711 Interface movement in salt-gradient solar ponds. Wittenberg, L.J. (Fusion Engineering Program, Nuclear Engineering Department, University of Wisconsin-Madison, Madison, Wisconsin). pp 1-5 of Solar Engineering -- 1984. Yogi Goswami, D. New York, NY, USA; A.S.M.E. (1984). (CONF-840402—).

From 6. annual ASME Solar Energy Division technical conference; Las Vegas, NV, USA (10 Apr 1984).

The movement of the lower convective zone/nonconvective zone interface was observed for over six months in a large solar pond. This movement was satisfactorily explained as due to the double diffusive flux of salt and heat from the lower convective zone to the surface. For a stable interface, these results imply that a maximum temperature gradient exists for each salt gradient. The relationship between the maximum temperature gradient and the salt gradient is shown to be correlated by a mobility term which is composed of the self-diffusion of sodium chloride, the viscosity of the solution and the diffusion of water, all at the temperature and concentration of the salt solution at the interface.

49712 Effect of soil conditions on solar pond performance. Leboeuf, C.M.; Johnson, D.H. (Solar Energy Research Inst., Golden, CO). pp 12-17 of Solar Engineering -- 1984. Yogi Goswami, D. New York, NY, USA; A.S.M.E. (1984). (CONF-840402—).

From 6. annual ASME Solar Energy Division technical conference; Las Vegas, NV, USA (10 Apr 1984).

A recent effort to design a one-acre solar pond at the U.S. Air Force Academy brought up several research issues pertaining to solar pond performance prediction. This report addresses those issues. Interactions of the pond with the soil below it have historically been estimated using very simplistic techniques that tend to ignore soil composition, moisture content, and the coupled heat and moisture transport phenomena. This study examines the models of soil thermal conductivity and heat and mass transport in soils under imposed temperature gradients to assess the potential applicability of these models to solar pond modeling. In addition, a computer simulation code is developed that incorporates the soil thermal conductivity model. Using the code, a parametric analysis was performed illustrating the impact of this property on pond behavior and the importance of experimental model verification for the range of soil temperatures experienced in solar ponds. Implications of the combined heat and moisture movement theory on solar pond performance are presented.

49713 Analytical optical power concentration calculations for reflection for spherical mirrors. Reichert, J.D.; Anderson, R.M.; Brock, B.C.; Ford, W.T.; Leung, H.; White, J.T. (Texas Tech Univ., Lubbock, TX). pp 57-63 of Solar Engineering -- 1984. Yogi Goswami, D. New York, NY, USA; A.S.M.E. (1984). (CONF-840402—).

From 6. annual ASME Solar Energy Division technical conference; Las Vegas, NV, USA (10 Apr 1984).

An analytic formula has been derived by Reichert and Brock for calculating the optical power concentration at a receiver point due to the sun's reflection on a mirror surface. Analysis of calculations for a spherical segment mirror and a cylindrical receiver are presented. These results give excellent agreement when compared with actual results obtained from the Crosbyton Solar Project analog design verification system at Crosbyton, Texas. This system features a 65-foot diameter fixed spherical collector and a tracking cylindrical receiver.

49714 Luminescent solar concentrators for energy conversion. Reisfeld, R.; Jorgensen, C.K. (Hebrew Univ., Jerusalem, Israel). pp 1-36 of Solar energy materials. Berlin, Germany, F.R.; Springer-Verlag (1982).

A description is given on the geographical, seasonal, and spectral distribution of terrestrial solar energy. The concept of nontracking fluorescent concentrators is discussed, together with the mathematical background for the collection and concentration of direct and diffuse light. Attention is also given to single plates, multiple stacks, and thin films doped by one or more colorants. An analysis is presented of the differences between inorganic and organic materials. In addition, suggestions are made for new hybrid systems. 83 references.

49715 Flat-plate solar array progress and plans. Callaghan, W.T. (California Inst. of Tech., Pasadena). pp 115-118 of Photovoltaic specialists conference. New York, NY, USA; Institute of Electrical and Electronics Engineers (1982). (CONF-820906—).

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

The emphasis of the Flat-plate Solar Array Project has been shifted from price goals and commercial development toward longer-term, higher risk, higher-potential-payoff opportunities. The revised objectives, status, and plans of the project are presented and technical progress is noted in the areas of: large-area sheet formation; silicon feedstock refinement; flat-plate module process sequence development; and engineering and environmental testing.

49716 Photovoltaic concentrator progress. Boes, E.C. (Sandia National Lab., Albuquerque, NM). pp 702-712 of Photovoltaic specialists conference. New York, NY, USA; Institute of Electrical and Electronics Engineers (1982). (CONF-820906—).

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

This paper gives a brief but comprehensive summary of the status of photovoltaic concentrator technology. It includes a discussion of various concentrator concepts; a report on the experiences of 6 experimental PV concentrator array fields; test results on more recent PV concentrator module designs; a discussion of data analysis tools; new results on concentrator component development; a discussion of the solar resource differences for flat plate and concentrating collectors; and a discussion of cost analyses and price targets for this technology. 19 references.

49717 Sandia concentrator array testing experiences. Gerwin, H.J.; Rogers, C.B.; Beavis, L.C. (Sandia National Lab., Albuquerque, NM). pp 1252-1255 of Photovoltaic specialists conference. New York, NY, USA; Institute of Electrical and Electronics Engineers (1982). (CONF-820906—).

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

An assortment of PV concentrator modules and arrays have been tested and evaluated at the Sandia outdoor test facility. These test items include actively-cooled parabolic reflector and linear Fresnel lens concentrators, and actively- and passively-cooled point focus collectors. Maximum power efficiencies were measured over a range of sunlight intensities and cell temperatures, then a linear equation relating efficiency to cell temperature and insolation was developed for each module and array by using a multiple linear regression analysis technique on the data. An evaluation of the suitability of Polyvinyl-Butyral (PVB) as a material used to laminate solar cells to glass is presented. Some general observations are made on the accuracy of tracking systems, and the maintenance of these systems.

1420 Heat Storage

REFER ALSO TO CITATION(S) 14200049710, 49967

49718 (CONF-8403146—1) Industrial work on latent heat storage. Kando, P.F. (Kando (Paul F.), Inc., Washington, DC (USA)). 1984. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001095.

From IEA workshop on latent heat stores; Stuttgart, F.R. Germany (5 Mar 1984).

This paper is a presentation of the state-of-the-art in commercially-available thermal storage products using phase change materials (PCMs) in the United States. After presenting a brief overview of the US building market and establishing the need for thermal storage, the presentation discusses needs for future development of PCM products.

49719 (TKK-F-A—507) Computational simulation of solar heating systems with seasonal heat storage. Lund, P.D. (Helsinki Univ. of Technology, Otaniemi (Finland)). 21 Mar 1983. 49p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84751670.

A detailed computational simulation model for solar heating with seasonal heat storage is presented. The heat-storage unit consists of a hot water tank excavated in a rock. The storage capacity of the surrounding ground may also be utilized. Different collector and orientation alternatives are considered. The model is used to evaluate the performances of some district solar heating systems for southern Finland using hourly meteorological data.

49720 (TKK-F-A—514) Dynamic model for thermochemical heat storage with application to solar heating. Peltola, S.S.; Lund, P.D.; Routti, J.T. (Helsinki Univ. of Technology, Otaniemi (Finland)). 16 May 1983. 25p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84751669.

A simple computational simulation model for liquid-based thermochemical heat storages is presented with emphasis on system dynamics. The model was applied for single-family house solar heating systems for Helsinki. Solar fractions up to 45% were obtained.

15 GEOTHERMAL ENERGY

REFER ALSO TO CITATION(S) 15000049959

49721 (EPRI-AP—3686) Proceedings: eighth annual geothermal conference and workshop. (Altas Corp., Santa Cruz, CA (USA)). Aug 1984. 215p. (CONF-8406201—). Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920020.

From 8. annual geothermal conference and workshop; Seattle, WA, USA (25 Jun 1984).

Separate abstracts were prepared for individual papers. Comments, opinions, and reommendations made during the Workshop Session and the Workshop Discussion Groups are summarized. (MHR)

1501 Resource Status And Assessment

49722 (LA-tr—84-30) Mineralogical aspects of the production of geothermal energy. Althaus, E. Translated from *Naturwissenschaften ;* **71**: 85-92(1984). Contract W-7405-ENG-36. 20p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002058. DE85002058

Exploitation of geothermal energy stored in hot dry rocks is subject to mineralogical and geochemical processes which may influence both the feasibility and economy of the systems. Whereas geophysical and technical problems are likely to be solved in the near future, care must be taken to avoid problems arising from rock-water interaction. Corrosion of rock surfaces, mobilization of minerals, scaling and deposition depend sensitively on rock and fluid composition. Underground processes can be directed by appropriate choice of fluid composition in a way that the performance of the system becomes optimal. This requires, however, petrological exploration and continuous geochemical supervision of a hot dry rock plant.

49723 Heat-transfer measurements of the 1983 Kilauea lava flow. Hardee, H.C. (Sandia National Laboratories, Albuquerque, NM). *Science (Washington, D.C.);* **222**: 47-48(7 Oct 1983).

Convective heat flow measurements of a basaltic lava flow were made during the 1983 eruption of Kilauea volcano in Hawaii. Eight field measurements of induced natural convection were made, giving heat flux values that ranged from 1.78 to 8.09 kilowatts per square meter at lava temperatures of 1088 and 1128 degrees Celsius, respectively. These field measurements of convective heat flux at subliquidus temperatures agree with previous laboratory measurements in furnace-melted samples of molten lava, and are useful for predicting heat transfer in magma bodies and for estimating heat extraction rates for magma energy.

1502 Geology And Hydrology Of Geothermal Systems

REFER ALSO TO CITATION(S) 15020049722

1503 Geothermal Exploration And Exploration Technology

49724 (PB—84-212554) Application of analytical methods for trace elements in geothermal waters. Part 2: Plombieres, Bains-les-Bains, Bourbonne (Vosges). Final report. Gijbels, R.; Van Grieken, R.; Blommaert, W.; Vandelannoote, R.; Van't Dack, L. (Commission of the European Communities, Luxembourg). 1983. 157p. (EUR—8871-EN). NTIS, PC E08/MF E08.

In the present work, only cyclic hydrothermal systems are discussed; in particular, three thermal stations in the Vosges area. The temperature of the thermal waters at the emergence ranges from 33 to 70C. The water, which is meteoric in origin, infiltrates to deep levels where it is heated for a relatively long period (at least 30 years). In the area studied, the geothermal gradient is rather high (1C/20m), which may explain the relatively high temperature of these waters. In depth, the waters get their typical chemical composition by interaction with the surrounding (aquifer) granites. During their upward movement, they cool and some of them become mixed with cold subsurface and/or surface waters.

49725 Geophysical studies of active geothermal systems in the Northern Basin and Range. Ward, S.H. (Earth Science Laboratory/University of Utah Research Institute, Salt Lake City, Utah). pp 121-157 of Role of heat in the development of energy and mineral resources in the Northern Basin and Range Province. Special Report No. 13. Davis, CA, USA; Geothermal Resources Council (1983).

Most of the geophysical data in the public domain, acquired in exploration for high temperature geothermal systems in the Northern Basin and Range Province, have been reviewed. Sufficient data are available to compare 14 methods at 13 sites, but only 110 entries occur in the 14 by 13 matrix whereas 182 entries would have been optimum. Only four of the sites studied are believed to be capable of production of commercial electricity while three others probably will be placed in this category in the next few years. For three additional systems believed to be capable of commercial production, insufficient geophysical data are available, in the public domain, to permit review. On a rating scale of 1 equals good through 4 equals poor, no geophysical method has a mean ranking of 1. Five methods rank about 2, six rank about 2.5, and three rank about 3, while none understood part of the system. uniformly applied to the question, "what contribution has the method made to understanding the reservoir or the presumed reservoir, at site X". The averages of the evaluations at each site are the rankings given above. No combination of any four methods has been successful at more than one site where "successful" means a ranking of 1 or 2. The most useful of the methods, judging by their average rankings, are heat flow, microearthquakes, gravity, resistivity, and self-potential. The least effective methods are earth noise, reflection seismology, magnetics, magnetotellurics and tellurics. The radiometric and induced polarization methods were excluded from the comparative study due to a paucity of data. The CSAMT method has been included with CSEM for purposes of this comparative study.

49726 Resistivity structure of the Northern Basin and Range. Wannamaker, P.E. (Earth Science Laboratory/University of Utah Research Institute, Salt Lake City, Utah). pp 345-362 of Role of heat in the development of energy and mineral resources in the Northern Basin and Range Province. Special Report No. 13. Davis, CA, USA; Geothermal Resources Council (1983).

Trustworthy models of northern Basin and Range resistivity have been lacking mainly due to an inadequate regard for the effects of upper crustal three-dimensional (3D) inhomogeneities upon the surface electromagnetic measurements. While geomagnetic deep sounding (GDS) is relatively insensitive to upper crustal complexity, the ability of GDS to resolve structure of interest at greater

depths is limited. The role of low-resistivity 3D structures near the surface has been documented most thoroughly for the magnetotelluric (MT) technique, although controlledsource electromagnetics (CSEM) using either grounded or ungrounded transmitters also is seriously complicated by inhomogeneities. The natural field methods of MT and GDS are preferred to CSEM for deep resistivity exploration due to the planewave nature of the source as well as to the availability of data at very low frequencies and of 2D and 3D modeling algorithms for treating upper crustal structure. Magnetotelluric measurements in S.W. Utah have detected a low-resistivity layer from 35 to 65 km depth in the upper mantle that is proposed to reflect an accumulation of basaltic melt in periodotite. GDS experiments and various tectonic indicators suggest that this melt is controlled by adiabatic upwelling and fusion along the eastern margin of the northern Basin and Range. Similar GDS anomalies and extensional processes appear active in the western margin of this province, implying a similar resistivity structure. This would leave the northern Basin and Range interior of central Nevada as a comparatively quiescent region with an upper mantle seismic low-velocity zone whose melt interconnection, and commensurate low resistivity, remain fairly intact.

49727 **Seismological investigations of volcanic and tectonic processes in the Western Great Basin, Nevada and Eastern California.** Vetter, U.R.; Ryall, A.S.; Sanders, C.O. (Seismological Laboratory, University of Nevada, Reno, NV). pp 333-344 of Role of heat in the development of energy and mineral resources in the Northern Basin and Range Province. Special Report No. 13. Davis, CA, USA; Geothermal Resources Council (1983).

The western Great Basin is structurally complex, and seismogenic processes vary within it. A significant increase in seismicity around the "White Mountains seismic gap", north of the rupture zone of the 1872 (M = 8+) Owens Valley earthquake, suggests that the potential for a major earthquake in the gap is greater than it has been for several decades. Seismicity within the "Stillwater gap" of northern Dixie Valley (Wallace, 1978) is very low and earthquakes that do occur there are small and shallow, suggesting that the potential for a large shock there in the near future is low. Earthquakes around the Adobe Hills Tertiary (ca. 3 m.y.) volcanic center show a tendency for temporal clustering, which appears to be characteristic of geothermally active areas in the Great Basin. Telescismic P-wave traveltime residuals indicate a low-velocity zone, possible a zone of partial melting, at shallow depth in the crust.

1504 Legal And Institutional Aspects

49728 **Geothermal energy development in Nevada's Great Basin. Hearing before the Subcommittee on Energy and Mineral Resources of the Committee on Energy and Natural Resources, United States Senate, Ninety-Eighth Congress, Second Session, April 17, 1984.** Washington, DC, USA; Government Printing Office (1984). 28p.

A field hearing in Sparks, Nevada on the status of geothermal development and on government participation in helping the geothermal industry get started heard testimony from state legislators and officials, government agencies, geothermal industry spokesmen, utilities and utility regulators, and consumer groups. Interest in geothermal development in the state is high because the resources are applicable to both space heating and power generation, and because they represent an opportunity to reduce the state's need to import 95% of its energy. Among the issues raised were regulatory barriers and economic disincentives to the use of geothermal energy. An appendix with additional material submitted for the record follows the testimony of 29 witnesses.

1505 Economic And Financial Aspects

REFER ALSO TO CITATION(S) 15050049728

1506 Environmental Aspects And Waste Disposal

REFER ALSO TO CITATION(S) 15060050573

1508 Geothermal Power Plants

REFER ALSO TO CITATION(S) 15080050298

1509 Geothermal Engineering

49729 **(DOE/NV/10354—1) Study of scale and noncondensables in an evaporator. Annual report, 1 October 1983-30 September 1984.** McDonald, C.W. (Texas Southern Univ., Houston (USA). Dept. of Chemistry). 1984. Contract AS08-83NV10354. 25p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001726.

The EPRI Geopressured Wellhead Project has considered using a flash evaporator to produce steam which will be heated and used in a steam turbine. Various possible arrangements for power production are discussed. In most of these arrangements there are potential problems with the brine chemistry related to scale formation. Emphasis of the research has been on the brine chemistry associated with the flash evaporation process. Specifically, the saturation index was used to predict scaling tendencies. Associated with the vaporization of the brine droplets are critical mass transfer and heat transfer processes which could have an effect on the scaling. From detailed investigation of these processes, scaling should not be a major problem in the evaporator.

49730 **Evaluation of the three-point method to measure corrosion rates.** Danielson, M.J. (Pacific Northwest Laboratory, Richland, Washington). *Corrosion (Houston);* **38**: No. 11, 580-586(Nov 1982).

The three-point method (TPM) as introduced by Barnartt, is shown to have some advantages over the linear polarization method in measuring corrosion rates. Experimental results on iron, theoretical limitations, and various potential sequences are discussed.

1520 Geothermal Data And Theory

REFER ALSO TO CITATION(S) 15200049729

49731 **(PB—84-213271) Compilation of thermodynamic data on water-mineral equilibria in hydrothermal reservoirs. Final report.** Michard, G. (Commission of the European Communities, Luxembourg). 1983. 158p. (In French). (EUR—8590-FR). NTIS, PC E08/MF E08.

A reappraisal of some of the thermodynamic data of the main minerals published by Helgeson et al (1978) was found necessary because of: the omission of thermodynamic data on certain ions published in the recent literature, and of chemical and mineralogical data on geothermal systems in New Zealand and Iceland, the lack of clarity in the statistical methods used, and possible errors in comparisons with other published results. It was therefore decided to compile valid data from various sources on geothermal systems within a temperature range of 0-300C and a pressure range of 1-1,000 bars. The data are presented in three sections: simple ions, complex ions, and minerals.

16 TIDAL AND WAVE POWER

1608 Wave Energy Converters

49732 (PB—84-205418) Hydrodynamic studies on floating attenuator wave energy devices. Count, B.M.; Miyazaki, T. (Central Electricity Generating Board, Southampton (UK). Technology Planning and Research Div.). 1983. 29p. (TB—466). NTIS, PC E04/MF E04.

In this paper the theory of optimal control is developed in a form in which non-absorbing modes of motion may be included in any system. The theory is developed for wave energy absorption by phase controlled systems and ones where only a simple resistive damping may be applied. The theory is applied to two attenuators based on the Kaimei concept. Firstly, a system of vertically oscillating pistons is considered which is intended to model a device with bottom opening oscillating water columns, and secondly horizontally moving pistons are considered. The latter system is analogous to a device containing side opening oscillating water columns.

17 WIND ENERGY

REFER ALSO TO CITATION(S) 17000049604, 49959

1706 Wind Energy Engineering

49733 (DFVLR-FB—84-10) Modelling of the overall aeroelastic system of a windturbine aided by symbolic programming. Kiessling, F. (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Koeln (Germany, F.R.); Technische Univ. Braunschweig (Germany, F.R.). Fakultaet fuer Maschinenbau und Elektrotechnik). 1984. 187p. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number DE84752111.

Investigation of the aeroelastic characteristics of rotary-wing systems requires very complex mathematical models when motions of the rotor are significantly coupled with those of the nonrotating structure. A typical example is the rotor/tower system of a wind turbine. In the first part, such a system is analysed considering the more important acting forces, followed by a sample calculation of stability and dynamic response. The rotor equations of motion on which the calculations are based are generated systematically with the aid of a computer in symbolic form. This procedure is kept of a general nature, so that is may be applied to similar problems in helicopter aeroelasticity.

49734 (DOE/R4/10161—T1) Energy on an independent farm. Final performance report. Dana, T.; Dana, C. (Dana (Tom and Caleb), Lumberton, MS (USA)). 1984. Contract FG44-80R410161. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000221.

This project was an attempt at achieving energy self-sufficiency on a small family farm and homestead. Phases of the project completed are as follows: (1) a water pumping windmill to provide supplemental irrigation water; (2) a solar greenhouse for starting plants during mid winter and drying or curing crops during late summer and fall that requires no supplemental heating system; (3) a solar hot water system that provides 100% of the hot water needs of the farm as well as heat storage for the greenhouse; and (4) a photovoltaic system theoretically capable of providing 100% of the electriciy needs of the farm.

49735 (EPRI-AP—3578) Wind power parks: 1983 survey. Dickson, E.M.; Loperena, G.A. (Strategies Unlimited, Mountain View, CA (USA)). Aug 1984. 169p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920031.

The purpose of this project was to survey the status of wind parks owned by non-utility organizations which generate electricity for sale to electric utilities under the provisions of the Public Utility Regulatory Policies Act. Both technical (including wind turbine descriptions) and business-related information were gathered from over 100 wind park developers who were interviewed by telephone or in person. Following the survey, the wind parks were screened so that only those already on-line or with very good possibilities of coming on-line by mid-1984 were included. This screening, although subject to judgment, was based primarily on the status of several of the critical milestones necessary for project completion. This document includes descriptions of 85 wind parks established by over 60 developers. Of these, 73 are located in California. This concentration in California is the result of the confluence of tax advantages, financial, institutional, and resource factors currently most favorably found in that state. For the wind parks described in this document, installed generating capacity (based on nameplate ratings) is 87 MW as of July 1983, with plans calling for aggregate installation of some 730 MW by mid-1984. Continued expansion in wind turbine installations over the next several years will require that wind turbines demonstrate high equipment availability with acceptable operating and maintenance costs. If these can be achieved, if the cost effectiveness of the equipment improves by 20%, and if borrowing terms improve, then wind parks could remain economically viable businesses for non-utility owners even after the current tax advantages expire.

49736 (GKSS—83/E/42) Test field Pellworm for wind turbines. Fries, S.; Bruegmann, J.; Petersen, G.; Mengelkamp, H.T. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1983. 48p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE84752110.

The wind energy converter BRUeMMER BW 120 S was tested at the GKSS test field Pellworm from August 1980 to November 1982. The manufacturer of the plant is: Hermann Bruemmer Windkraftanlagen KG, Muehlenstrasse 8, Helmarshausen, 3522 Bad Karlshafen. Qualitative as well as quantitative test results are described. Especially a definitive power curve was determined. By means of this curve the annual energy production for a site with a known annual mean of the wind speed can be calculated.

49737 (N—84-21903) Thermal stress analysis for a wood composite blade. Fu, K.C.; Harb, A. (Toledo Univ., OH (USA)). Apr 1984. 117p. (NASA-CR—173394). NTIS, PC A06/MF A01.

Heat conduction throughout the blade and the distribution of thermal stresses caused by the temperature distribution were determined for a laminated wood wind turbine blade in both the horizontal and vertical positions. Results show that blade cracking is not due to thermal stresses induced by insulation. A method and practical example of thermal stress analysis for an engineering body of orthotropic materials is presented.

49738 (RISO-M—2403) Test report for VESTAS windmill, type 15, 55 kW. Standard measurements. Rasmussen, P. (Risoe National Lab., Roskilde (Denmark)). Nov 1983. 38p. (In Danish). NTIS (US Sales Only), PC A03/MF A01. File Number DE84751634.

The report contains measurements carried out using the standard procedure. The measurements give information about annual energy production, power regulations by aerodynamic stall, system-efficiency, and loads under cut-in and braking. Furthermore is refered to measured loads from an intensive test program. In appendixes is placed the result from noise measurements carried out of the Danish Boilers Association.

49739 (RISO-M—2406) Test report for Kramsbjerg windmill 14 kW. Standard measurements. Rasmussen, P. (Risoe National Lab., Roskilde (Denmark)). Jan 1984. 29p. (In Danish). NTIS (US Sales Only), PC A03/MF A01. File Number DE84751635.

This report contains measurements carried out using the standard procedure. The measurements give information about annual energy output, power regulation, system efficiency and load at braking.

49740 **(RISO-M—2419) Test of windmill control unit from Skjern Elektro Aps and Styrdata.** Rasmussen, P. (Risoe National Lab., Roskilde (Denmark)). Feb 1984. 19p. (In Danish). NTIS (US Sales Only), PC A02/MF A01. File Number DE84751636.

A control unit has been tested by measurements during normal operation and failure situations. The tests include: start-up with motor help, generator cut-in and out, activation of the mechanical brake and grid survey functions.

49741 **(SL—82211-01-Pt.1) Measurements of 55 kW Nordtank windmill sited at Knebel, Mols. Background report.** (Skibsteknisk Laboratorium, Lyngby (Denmark)). Mar 1983. 74p. (In Danish). NTIS (US Sales Only), PC A04/MF A01. File Number DE84751637.

The background report describes the measuring equipment and analysis used to obtain the results as described in the main report. All the data of the measurements are presented.

49742 **(SL—82211-01-Pt.2) Measurements of 55 kW Nordtank windmill sited at Knebel, Mols.** (Skibsteknisk Laboratorium, Lyngby (Denmark)). Mar 1983. 39p. (In Danish). NTIS (US Sales Only), PC A03/MF A01. File Number DE84751638.

The effect characteristic and efficiency of the windmill are defined in the wind speed range of 1 - 22 m/s. Energy production starts at about 3 m/s. At about 10 m/s the effect is 40 kW. A nominal effect of about 54.6 kW was measured at a wind speed of 16 m/s. The largest efficiency of the windmill is about 0.37 and is obtained at a wind speed of 7.5 m/s. The expected yearly production at the actual site is estimated to 148.000 kWh. The yearly power production, when the windmill is placed in water area, is estimated to 180.000 kWh, and to 60.000 kWh when placed in bad areas. The rotor turning moment at braked rotor is measured at a wind speed between 2 m/s and 7 m/s, where aerodynamic forces causes a moment in the rotor axis of about 30 - 400 Nm. Testing of air brakes with unloaded rotor is made at wind speed of 9 m/s to 19 m/s. Under these conditions the rotation is measured to be about 52 - 88 RPM.

20 ELECTRIC POWER ENGINEERING

49743 **(DOE/ET/29366—1) Methodology for power system emergency state control.** Usoro, P.B.; Rouhani, R. (Scientific Systems, Inc., Cambridge, MA (USA)). Mar 1983. Contract AC01-79ET29366. 43p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85001146.

The development of a stochastic approach to solving the emergency control problem in electric power systems is presented. It identifies slow speed dynamics and cascading failures as characterizing many major electric system collapses and presents a probabilistic representation of the uncertain changes in power system configuration. The control algorithm looks several time steps ahead to account for system uncertainty and is aimed at guiding the system from emergency state back into a normal state in an optimal fashion. The main contribution of this research project is that the uncertainty in power system dynamics is clearly addressed and the emergency state control problem is formulated as a stochastic control problem to reflect the true nature of the system. Futhermore, the stochastic control problem is solved using a sequential decision tree strategy with manageable computational requirement.

49744 **(NP—5900049) 1982 analyses and reports: equipment availability report; component cause code report; and equipment availability report.** (North American Electric Reliability Council, Princeton, NJ (USA)). 1982. 496p. NERC, Research Park, Terhune Road, Princeton, NJ 08540. File Number TI85900049.

This equipment availability report (1973 to 1982, 1982) presents statistical information on the performance of the major types of generating units and their major component groups. (DLC)

2001 Power Plants And Power Generation

REFER ALSO TO CITATION(S) 20010049328, 49590, 49590, 49757, 49791, 50053, 50431, 50504

49745 **(EPRI-CS—3644) Advanced intake technologies study. Final report.** (Stone and Webster Engineering Corp., Boston, MA (USA)). Sep 1984. 267p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920012.

The objective of this study was to scope a research program to evaluate and compare the operating performance, cost, and reliability of selected fish protection systems. Recently, renewed studies of behavioral barriers have shown that, used alone or in combination, they may be effective in preventing the entry of fish into water intakes under the proper design and operating conditions. Therefore, all behavioral barriers, physical barriers, collection and removal systems, and diversion systems were assessed from a biological and engineering viewpoint in order to select systems for further study. The technologies which have potential but require further evaluation were ranked. The ranking methodology used informed professional opinion on the importance of various levels of specific design criteria and the importance among design criteria. Fifty-four professionals responded to the mail survey. Eleven technologies were ranked and matched with potential test sites. Behavioral barriers are to be tested at several sites and data are to be transferred to the Electric Power Research Institute (EPRI) from several other existing intake facilities with angled screens, modified fish screens, and wedge-wire screens. Biological and engineering test methodologies were developed together with design schemes for behavioral barriers at each test site. Estimated costs, including direct, operating, and maintenance costs, were developed for each site and for the whole evaluation program.

49746 **(EPRI-CS—3716) Large unbalance vibration analysis of steam turbine generators. Final report.** Adams, M.L. Jr. (Case Western Reserve Univ., Cleveland, OH (USA)). Sep 1984. 85p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920011.

The purpose of this project was to pursue in more depth than earlier work the analysis of large-unbalance vibration in large steam turbine units. The earlier work served to identify a previously unrecognized mode of potentially massive failure, namely, high amplitude subharmonic resonance of the rotor/bearing system. This phenomenon appears to have possibly played a major role in three massive failures that are briefly reviewed herein. The more extensive results of the analyses performed in this project provide a greatly enhanced definition of what typical level of unbalance is required to trigger large amplitude subharmonic resonance. It was found on turbines operating below the oil-whip threshold speed that a critical magnitude of unbalance exists above which relatively small additional amounts of unbalance cause a rapid increase in subharmonic and overall vibrations to potentially catastrophic levels. Simultaneous occurrence of oil-whip vibration and a large rotor unbalance is shown to produce even substantially higher vibration and dynamic force levels than with the large unbalance alone. It was also found that the previously shown superiority of pivoted-pad journal bearings in controlling subharmonic resonance exists with or without pad preloading and with either rigid or typically flexible pivots for the bearing pads.

49747 **(EPRI-EL—3564-SR) Generator monitoring and surveillance: workshop proceedings.** Sharma, D.K.; White, J.C. (eds.). (Electric Power Research Inst., Palo Alto, CA (USA). Electrical Systems Div.). Aug 1984. 250p. (CONF-8310313—). Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920008.

From EPRI workshop on generator monitoring and surveillance; Dallas, TX, USA (19 Oct 1983).

In the past few years, there has been increasing interest in generator monitoring and surveillance. New generator monitoring devices have been developed, and new problems with existing monitors have been identified by the utilities. The purpose of this Workshop was to plan further industry efforts in the area of generator surveillance and monitoring by bringing together the users and

the manufacturers to discuss problems encountered so far with the existing devices, as well as the future needs of the utility industry. The Workshop was attended by representatives from utilities, manufacturers and universities. Proceedings of the Workshop are contained in this report.

49748 **(KHM-TR—72) Cost of coal-fired plants and related equipment for environmental protection.** Lagerstedt, G.; Litzen, K.A.; Hoek, J.; Schwarz, J.; Lundgren, T. (Statens Vattenfallsverk, Vaellingby (Sweden). Projekt KOL-HAELSA-MILJOE). Aug 1983. 160p. (In Swedish). NTIS (US Sales Only), PC A08/MF A01. File Number DE84751662.

The report presents the costs of coal-fired plants and related equipment for environmental protection for district heating-water plants, combined power and heat plants and condensing power plants. The economic calculations have been carried out at a stable value of currency in 1982 at a real interest of 4 percent. The depreciation period is 25 years. The report contains a presentation of the costs of: - different types of coal raw material. - coal import harbour, unloading, handling, storing and transport of coal up to the user. - coal-fired plants with very reduced measures for environmental protection. - coal store and unloading devices satisfying varying environmental protection regulations. - reduced emission technique. - flue gas desulphurization. - nitrogen oxide reduction. - disposal of fly ash.

49749 **(MTR—80W76-03) Coal combined cycle system study. Volume III. Concept descriptions.** (Mitre Corp., McLean, VA (USA). METREK Div.). Apr 1980. Contract AC01-78ET10425. 266p. NTIS, PC A12/MF A01; GPO Dep. File Number DE84012982.

The potential advantages for proceeding with demonstration of coal-fueled combined cycle power plants through retrofit of a few existing utility steam plants have been evaluated. Two combined cycle concepts were considered: Pressurized Fluidized Bed (PFB) combined cycle and gasification combined cycle. These concepts were compared with AFB steam plants, conventional steam plants with Flue Gas Desulfurization (FGD), and refueling such as with coal-oil mixtures. The ultimate targets are both new plants and conversion of existing plants. Combined cycle plants were found to be most competitive with conventional coal plants and offered lower air emissions and less adverse environmental impact. A demonstration is a necessary step toward commercialization.

49750 **(OEFZS—4275) Operating experience with potassium systems.** Schwarz, N.F. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). Apr 1984. 9p. (RS—237/84). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703152.

In an international cooperation R and D work for the realization of potassium topping cycles to increase the conversion efficiency of thermal power stations is going on. Feasibility studies show that the realization of such a process can be achieved under economic considerations with existing materials and today's technology. Nevertheless, it has to be shown that the assumptions with respect to material behaviour and component reliability are based on sound technical premises. Therefore, in continuation of design studies, a hardware programme has been initiated in the Austrian Research Centre Seibersdorf. First results with respect to component and material behaviour are described.

49751 **(CE-Trans—8006) Survey of research work on injection cooling at Delft Technical University.** van Lier, J.J.C.; van Paassen, C.A.A. Translated from *VGB Kraftwerkstechnik ;* **60**: No. 12, 958-969(1980). 30p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84901817. DE84901817

In the early 1950s there was a rapid increase in power station construction. For example, the pressures and temperatures became increasingly higher and development is still continuing in the form of ever larger plants. Consequently the various plant components have to meet far more stringent requirements and great importance is attached to good interaction of the different components. This led to new considerations in component design and many new calculation methods were developed. However, the injection cooler - the component which is to control the high temperatures - is still being designed as in the fifties, i.e. the cooling section is determined with the aid of data collected under practical conditions and the cooler itself is usually designed purely intuitively. However, it is necessary to be aware that malfunctioning of an injection cooler not only leads to control problems, but also to thermal shock phenomena. Serious damage as a result of defective operation of injection coolers has occurred even in recent decades and led to the start of research work in the field of combined atomisation and evaporation at the Energy Engineering Laboratory of Delft Technical University in 1961. The aim was to devise a computer model, which can be used to design the atomiser/cooler combination in such a way that the cooling section is really as short as possible and - as was hoped at the time - wall contact by water drops can thus be avoided under all circumstances.

2002 Environmental Aspects

REFER ALSO TO CITATION(S) 20020049388, 49389, 49391, 49392, 49393, 49394, 49395, 49401, 49432, 50437, 50652

49752 (DOE/FE/60181—1642, pp 6.1-6.13) **SO/sub x// NO/sub x/ control.** Weber, G.F. Aug 1984. NTIS, PC A12/MF A01. File Number TI84017327.

In Low-rank coal research. Quarterly technical progress report, April-June 1984.

Results of testing pressure hydrated lime as an adsorbent for sulfur dioxide are reported for combustion systems burning lignite, propane and natural gas. The chemical reactions involved are described as is the method of pressure hydration of the lime. The optimum injection temperature was different for the three fuels. Bench scale tests of combined SO/sub x//NO/sub x/ and particulate control tests are described: These involve injection of pressure hydrated lime for SO_2 control, selective catalytic reduction for NO/sub x/ control and ceramic filters for particulate control. 8 references, 3 figures, 6 tables. (LTN)

49753 (DOE/FE/60181—1642, pp 7.1-7.18) **Particulate characterization.** Miller, S.J. Aug 1984. NTIS, PC A12/MF A01. File Number TI84017327.

In Low-rank coal research. Quarterly technical progress report, April-June 1984.

UNDERC has found that the baghouse penetration of fly ash from different lignites varies considerably. Regression analysis shows that this variation is dependent on the chemical composition of the fly ash, with the percentage of Na_2O being the most important factor but with MgO and P_2O_5 percentages also being significant. Certain differences in the particle size distribution of the fly ash of the different lignites and also variations in composition with particle size are reported. The effects of electrical properties of the baghouse filter materials are discussed. It is hoped that a detailed understanding of lignite- and collector-specific emission properties will enable improved collector design. 9 references, 9 figures, 3 tables. (LTN)

49754 (DOE/METC—84-6, pp 387-394) **Testing and evaluation of ESP at Curtiss-Wright.** Kumar, K.S. (Cottrell Environmental Sciences, Somerville, NJ). Dec 1983. NTIS, PC A21/MF A01. File Number DE84000216. (CONF-8305112—).

From 3. annual contractors' meeting on contaminant control in hot coal derived gas streams; Washington, PA, USA (24 May 1983).

This report to the US Department of Energy discusses the testing and evaluation of the electrostatic precipitator (ESP) that was installed at the government furnished pressurized fluidized bed combustor (PFBC) test facility located at Curtiss-Wright, NJ. Test data on a short term ESP operation at 1400 to 1500°F and 84 psia showed that particulate collection efficiencies in the range of 98 to 99.5% are possible and have the potential for meeting DOE's particulate control goals ahead of the gas turbine. The key test program to evaluate ESP at 1600°F and 94 psia could not be properly implemented because of severe damage to ESP internals prior to the test program. The damage was caused by several water floods into the ESP resulting from flow control upsets in the downstream

pressurized water scrubber in the PFBC system. The damaged ESP showed particulate collection efficiencies in the 75 to 85% range. Recommendations are made for future course of study with ESP so that the testing and evaluation program at 1600°F and 94 psia can be fully implemented. 2 references, 4 figures.

49755 (DOE/METC—84-6, pp 395-407) **Performance of an electrostatic precipitator at simulated PFBC conditions.** Rinard, G.; Rugg, D.; Durham, M.; Yamamoto, T.; Armstrong, J. (Denver Research Inst., CO). Dec 1983. NTIS, PC A21/MF A01. File Number DE84000216. (CONF-8305112—).

From 3. annual contractors' meeting on contaminant control in hot coal derived gas streams; Washington, PA, USA (24 May 1983).

Stable corona conditions were obtained for both clean and dirty conditions for temperatures between 743° to 916°C (1370° to 1680°F). Collection was best for negative corona. The operating voltage was reduced by the introduction of fly ash for temperatures above 743°C (1370°F) to approximately one half that for clean conditions. Collection efficiency for negative corona was high for all cases but was less for temperatures above 743°C (1370°F) because of the reduced operating voltage. Thermal ionization did not apear to be a significant factor in the precipitator's operation for the conditions tested. The decreased operating voltage for the higher temperatures appeared to be due to enhanced corona production. The operating voltage can be increased by a change in the design of the corona electrode. This should lead to significantly higher efficiencies for all conditions. A different design in the corona electrode could also significantly reduce the input power requirements without reducing collection efficiency. 4 references, 7 figures, 2 tables.

49756 (DOE/METC—84-6, pp 441-462) **Some recent progress in acoustic agglomeration of power plant fly ash.** Reethof, G.; McDaniel, O.H. (Pennsylvania State Univ., University Park, PA). Dec 1983. NTIS, PC A21/MF A01. File Number DE84000216. (CONF-8305112—).

From 3. annual contractors' meeting on contaminant control in hot coal derived gas streams; Washington, PA, USA (24 May 1983).

Acoustic Agglomeration is a method of providing an intermediate conditioning of the aerosols of coal fired electric utility boilers and also the products of combustion of fluidized, pressurized coal combustion systems. In both cases the gaseous products contain substantial concentrations of solid particulates which are first treated with conventional particle removal methods removing the large particles and leaving the majority of submicron particles which are on one hand injurious to the human respiratory system and on the other hand causing damage to gas turbine blades and vanes by erosion and coating. Subjecting these remaining aerosols to high intensity acoustic fields in the sonic frequency range has been shown to result in severalfold increases in the mean particle size. Thus subsequent conventional particle removal devices can operate much more efficiently removing the bulk of the now enlarged particles. Conclusions of this study are: (1) acoustically generated turbulence does not appear to be a significant factor in the agglomeration process which will be dominated by the acoustic velocity caused kinetic effects; (2) agglomerated particles appear to be sufficiently robust to withstand cyclone imposed shear stresses; and (3) the 700°F agglomerator has functioned quite well. The results show that the 150 to 160 dB range of acoustic intensities gives substantial agglomeration virtually eliminating particles up to about 5 microns. There is an optimum frequency of about 2500 Hz for fly ash particles with a mean size of about 2 microns. Exposure times of 10 seconds give excellent results. Lower times will give somewhat less agglomeration. Increased loading up to about 20 g/m^3 gives increased agglomeration. Increasing temperatures will give somewhat reduced agglomeration because of the increased drag on the particles from the higher viscosity. 12 references, 12 figures, 1 table.

49757 (LA-UR—84-2727) **New look at small power plants: an update on the environmental issues of interest to Italy.** Ford, A.; Roach, F.; Williams, M.D. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 70p. (CONF-8405235—1). NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE84016796.

From International congress on the prospects and problems of coal-fired power plants; Brindisi, Italy (10 May 1984).

An interdisciplinary group of scientists at the Los Alamos National Laboratory launched a study of small versus large coal-fired power plants in 1978. The study focused on impacts in the Rocky Mountain states. One purpose of this paper is to re-examine the results of the 1978/1979 Los Alamos study in light of the changing attitudes in the US on the appropriate scale of new thermal power plants. We summarize the growing interest in small, short lead-time capacity additions in this country, and we attribute this interest to the financial and planning advantages that smaller plants offer to the investor-owned utilities. The current status of techniques is discussed for the assessment of environmental impacts, specifically for the assessment of air quality impacts. Unresolved problems in methodology and consequence evaluation are briefly described. The application of existing techniques to small and large power plant options reveals a number of important air quality-related differences. The differences relate primarily to siting constraints and impairment of visibility. Large plants produce much more frequently visible plumes and plumes that are much more objectionable. Large plants are also much more difficult to site in hilly terrain. Smaller plants have available a much greater variety of sites and the terrain can be used to hide and disperse the smoke plumes. Smaller plants characteristically have much shorter start-up times and tend to have more reliable operation. The remaining environmental issues examined in the original Los Alamos study - health and safety impacts, uses of water, and socio-economic impacts in the nearby communities are discussed. 35 references, 17 figures, 5 tables.

2003 Power Transmission And Distribution

49758 (DOE/ET/25003—T1) **Particle charging in a turbulent air stream.** Radun, A.V. (Massachusetts Inst. of Tech., Cambridge (USA)). Feb 1981. Contract AS01-77ET25003. 306p. NTIS, PC A14/MF A01; 1; GPO Dep. File Number DE85001324.

The objective is a model for estimating the rate of electrical precipitation of macroscopic particles onto insulators where the particle charging is due to ions generated by the line and associated apparatus. The general theoretical structure required to describe particle charging and convective turbulent diffusion in a state-space of position and mobility is developed as a basis for predicting deposition in specific configurations. A wind tunnel facility is described for testing predictions of the theory for charging in the vicinity of a power line. The tunnel is equipped to control the turbulence level, with monodisperse zero-charge particles introduced upstream of a cable which is itself in a controlled state of corona discharge. Equipment for measuring the spatial distribution and mobility distribution at a downstream plane includes an electric analyzer, particle neutralizer and mass monitor. The theoretical model, which predicts the lower extreme of the observed mobility distribution but a lesser spread than found experimentally, points to either a need for greater resolution in the mobility spectrum analyzer, or the existence of near-line turbulence generation associated with corona wind.

49759 (DOE/RA/50156—5) **Determination of threshold and maximum operating electric stresses for selected high voltage insulations. Task III. Investigation of high voltage capacitor insulation. Progress report No. 4.** Sosnowski, M.; Eager, G.S. Jr. (Cable Technology Labs., Inc., New Brunswick, NJ (USA)). Mar 1984. Contract AC02-80RA50156. 45p. NTIS, PC A03/MF A01; GPO Dep. File Number DE84017051.

This report covers the investigation of threshold voltage of capacitor insulation. The experimental work was performed on samples prepared from commercial polypropylene insulated, liquid-filled capacitors. The samples were vacuum-impregnated with the original capacitor insulating liquid obtained from the manufacturer. A limited number of full-size capacitor elements also were tested. Impulse voltage breakdown tests with dc voltage prestressing were performed at room temperature and 75°C. From the results of these tests, the threshold voltage of the samples of the capacitor insulation was determined at both temperatures and that of the whole ca-

pacitor elements at room temperature. The threshold voltage of the capacitor insulation was found to be approximately equal to the impulse breakdown voltage. No difference was found between the threshold voltage at room temperature and at 75°C. The threshold voltage of the whole capacitor elements at room temperature was found to be equal to approximately 80% of the threshold voltage of the capacitor insulation samples.

49760 **(NP—4770532) Studies on load management in the range of minute-to-minute up to hour-to-hour planning by means of dynamic optimization.** Lutz, R. von. (Hochschule der Bundeswehr Muenchen, Neubiberg (Germany, F.R.). Facbereich Elektrotechnik). Jul 1983. 215p. (In German). NTIS (US Sales Only), PC A10/MF A01. File Number DE84770532.

The actual task of this study is the investigation and resolution of processes relative to the problem of load management in the range of minute-to-minute up to periods of one hour in general, which includes both the aspect of efficiency and the co-operation of power plants in order to maintain an equilibrium of power outputs. In other words, it is based on the field of momentary load management, yet includes also such issues as output frequency control. It is said explicitly that it is load estimates that are to enable the anticipating management of power plants. As marginal parameters there are time-dependent changes in the load and the dynamic behaviour of power plants. Both must be considered in the pursuance of the global goal. The finding on dominating influences will be part of a new proceeding appropriate for application in practice exceeding momentary optimization and is designed to open up new perspectives for power plant operation.

49761 **(PB—84-199553) Simple transmission network planning method: Wisconsin power plant impact study.** Albuyeh, F.; Skiles, J.J. (Wisconsin Univ., Madison (USA). Dept. of Electrical and Computer Engineering). Jul 1983. 170p. NTIS, PC A08/MF A01.

Prepared in cooperation with Madison Gas and Electric Co., WI, Wisconsin Public Service Corp., Green Bay, Wisconsin Public Service Commission, Madison, and Wisconsin Dept. of Natural Resources, Madison. Portions of this document are not fully legible.

In the process of evaluation and comparison of the proposed alternative power generation sites, the transmission network required to carry power effectively and reliably from the plant to the load centers requires careful consideration. The existing transmission network must be reinforced to accommodate these generation expansion plans and then should further be expanded as the load level increases. Therefore, a need exists for a transmission network expansion algorithm to provide a transmission network expansion plan over several planning periods for a given load and generation profile. The transmission network planning method developed here uses the same logical steps followed in practice by utility planning engineers and uses sensitivity matrices to supplement the experience of the planning engineers. The network is modeled either by a DC power flow model or by a Fast-Decoupled AC power flow model. To every branch a cost factor is associated which reflects capital costs and operational cost of the branch. Also included in the cost factor, is an environmental cost associated with increasing the capacity of the branch. The environmental cost in turn may include such factors as political and geographical constraints. To enable the planner to concentrate on a small area of interest, or to reduce the system size, a classical network reduction algorithm is utilized to model the external system by simple equivalents.

21 NUCLEAR POWER PLANTS

REFER ALSO TO CITATION(S) 21000049744

49762 **(N—84-20877) Laboratory measurements of subsynchronous resonance.** Limebeer, D.J.N.; Harley, R.G.; Lahoud, M.A.; Nattrass, H.L. (Natal Univ., Durban (South Africa)). 1980. 14p. (RL—8845; CONF-8009270—1). NTIS, PC A02/MF A01.

From IFAC symposium on autom control in power generators; Pretoria, South Africa (15 Sep 1980).

A selection of results obtained from a laboratory system specially designed to investigate subsynchronous resonance are presented. This laboratory system was designed to model as closely as possible the nuclear powered turbo-generators to be installed at Koeberg power station in South Africa. In the case of some of the laboratory measurements, equivalent theoretical results are also presented in order to test the validity of the mathematical models being employed. The theory describing the system dynamics and some of the features of the laboratory system are presented.

49763 **(NUREG—0020-Vol.8-No.8) Licensed Operating Reactors. Status summary report, data as of July 31, 1984. Volume 8, No. 8.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Resource Management). Sep 1984. 382p. NTIS, PC A17/MF A01 - GPO*. File Number TI85900257.

This Summary Report provides data on the operation of nuclear units as timely and accurately as possible. This report is divided into three sections: the first contains monthly highlights and statistics for commercial operating units, and errata from previously reported data; the second is a compilation of detailed information on each unit, provided by NRC Regional Offices, IE Headquarters and the Utilities; and the third section is an appendix for miscellaneous information such as spent fuel storage capability, reactor years of experience and non-power reactors in the United States.

49764 **(NUREG/BR—0051-Vol.6-No.2) Power Reactor Events, March-April 1984. Volume 6, No. 2.** Massaro, S.A. (ed.). (Nuclear Regulatory Commission, Washington, DC (USA). Office for Analysis and Evaluation of Operational Data). Sep 1984. 58p. NTIS, PC A04/MF A01 - GPO*. File Number TI85900261.

Power Reactor Events is a bi-monthly newsletter that compiles operating experience information about commercial nuclear power plants. This includes summaries of noteworthy events and listings and/or abstracts of USNRC and other documents that discuss safety-related or possible generic issues. It is intended to feed back some of the lessons learned from operational experience to the various plant personnel, i.e., managers, licensed reactor operators, training coordinators, and support personnel.

49765 **(NUREG/CR—3824) CONTING Program Guide.** Henry, E.B.; Gentillon, C.D.; Steverson, J.A. (EG and G Idaho, Inc., Idaho Falls (USA)). Sep 1984. 134p. (EGG—2315). NTIS, PC A07/MF A01 - GPO* $5.50. File Number TI85900039.

CONTING is an interactive computer program for automated trends and pattern analysis of data. The data are Licensee Event Reports, which are coded into a computer-readable, searchable Sequence Coding and Search System (SCSS) format developed by the US NRC. In the SCSS, the data are broken down into occurrences or steps, which are described by categorical variables such as system, component, and cause. CONTING searches the steps to obtain counts for contingency tables. The rows and columns of these tables correspond to user-specified conditions for the variables. The pattern of counts appearing in such a table can provide insights concerning the operational experience at nuclear power plants. In addition, CONTING supports trend analysis since the counts can be grouped by the associated event dates. A statistical package formats the contingency tables; this facilitates the use of log-linear statistical analysis to analyze them. Finally, the input automatically prepared for the statistical program may include exposure times for use in normalizing the counts to obtain occurrence rates. CONTING has many features to aid the user in performing this analysis.

2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

REFER ALSO TO CITATION(S) 21010049523, 49791, 49845, 49853, 49856, 49862, 49866, 49876, 49887, 49889, 49894, 49895

49766 **(EPRI-NP—3663) BWR water chemistry impurity studies: literature review of effects on stress corrosion cracking.** Ljungberg, L.; Hallden, E. (ASEA-ATOM AB, Vaesteraas (Sweden)). Sep 1984. 43p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920007.

Recently it has been shown by several investigators that impurities in the BWR environment can enhance intergranular stress corrosion cracking (IGSCC) of sensitized stainless steel. As a background for a project to systematize knowledge on this phenomenon, Swedish experience and the results of a literature survey have been reviewed. An overview of impurities known to occur, regularly or incidentally, in the BWR primary environment is given. An account is given on what is known of the effect of the various types of impurities on materials used in pressure-bearing systems in BWRs. The various possible mechanisms for enhancement effects of impurities are discussed. Recommendations are given as to which tasks should be emphasized in the forthcoming study. Present knowledge is particularly weak concerning effects of anions of weak acids. 89 references, 10 figures.

49767 (INIS-mf—8881, pp vp) **Loadings in horizontal feedwater pipes of LWRs by thermal shock and temperature differences due to thermal layers.** Miksch, M.; Lenz, E.; Loehberg, R. (Kraftwerk Union A.G., Erlangen (Germany, F.R.)). 1983. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84780610. (CONF-8310224—).

From MPA seminar on safety of light water reactor pressure vessels; Stuttgart, F.R. Germany (13 Oct 1983).

The fractographic assessment and orientation of the cracks present showed that these were due to alternating stresses in the axial direction. A comparison of stresses in thermal shock and temperature differences due to thermal layers shows that the cracks are largely due to the temperature differences due to thermal layers because of the load figures allocated. The orientation of the cracks also shows this (for termal shock stresses the surface stresses in the longitudinal and circumferential directions are equal). The present results of corrosion experiments show that with an appropriate oxygen content and temperature level, the rate of strain in temperature differences due to thermal layers has an appreciable effect on the crack load figure. In the conservative test conditions described, one can fall below the values of the ASME fatigue design curve. For strain rates applying for thermal shock, the crack load figures lie on the safe side of the curve.

49768 (INIS-mf—8881, pp vp) **US NRC research on the integrity of piping in nuclear reactor primary systems.** Serpan, C.Z. Jr. (National Research Council, Washington, DC (USA)). 1983. NTIS (US Sales Only), PC A22/MF A01. File Number TI84780610. (CONF-8310224—).

From MPA seminar on safety of light water reactor pressure vessels; Stuttgart, F.R. Germany (13 Oct 1983).

This paper has attempted to provide a "snapshot" of the activities underway in NRC on the subject of LWR piping integrity as of the summer and fall of 1983. The paper is necessarily vague on certain topics of policy because they are either under review or are under development and the outcome cannot be accurately forecast at this time. Particularly in the area of BWR pipe cracking, events are very rapid so that positions and actions described in this paper may well be obsolete by the time it is published. Nevertheless, the activities and positions are as accurate as possible at the time of writing. Certainly the longer-range aspects of the research program represent the current direction and intent of NRC; nevertheless, as results come in and actions occur in the licensing and regulation arena of operating reactors, the emphasis of the research programs will necessarily shift to accommodate them so as to remain as relevant as possible. Thus, this paper is useful to show the intentions of NRC in the area of research for LWR piping, and it is also useful to document the status of the regulations on piping for which the research is being performed.

49769 **(CE-Trans—7966) On-line acquisition and evaluation of core measuring data in light water reactors.** Grondey, G.; Gebureck, P.; Stegemann, D. Translated from *Atomkernenergie/Kerntechnik ;* **41**: No. 3, 195-199(1982). 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84901822. DE84901822

A multi-channel on-line noise analysis system (MONAS) designed for early fault detection is described and the experience gained from applying it at a nuclear power plant is given. Reduction of measured data is done by calculating stochastic functions. The characteristic values are automatically checked against preset limits. Any transgression of these limits initialises permanent recording of the data obtained during the last 8 hours before the event and starts analog recording of the noise signals. This allows a very detailed analysis of the data, especially of those preceding the event, and provides criteria for early fault detection. Experience gained during an on-line surveillance of 32 LPRM signals of the BWR demonstrates the broad potential of the system.

2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

REFER ALSO TO CITATION(S) 21020049523, 49767, 49768, 49791, 49818, 49819, 49820, 49821, 49822, 49823, 49824, 49848, 49853, 49856, 49857, 49862, 49866, 49868, 49871, 49876, 49877, 49879, 49880, 49881, 49883, 49890, 49894, 49895, 49898, 49900, 49901, 50116, 50412, 50586

49770 **(DOE/ET/34014—16) Extended Fuel Burnup Demonstration Program. Summary final report.** Moss, H.D. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Nuclear Energy Systems Div.). Sep 1984. Contract AC02-79ET34014. 45p. (WCAP—10673). NTIS (US Sales Only), PC A03/MF A01; GPO Dep. File Number DE85002113.

The program covered five areas of investigation. The Generic Technical Studies portion investigated the implications of extended fuel burnup relating to nuclear design considerations, safety and licensing analysis, fuel management schemes, and related fuel cycle service concerns. The Surry 2 Burnup Extension obtained fuel performance data with nondestructive and destructive examinations on a Westinghouse 17 x 17 demonstration fuel assembly operated to extended burnup in VEPCO's Surry Unit 2 reactor. The Fuel Storage Analysis included fuel storage rack criticality and high burnup source term evaluation. The Shipping Cask Analyses investigated whether shipping cask designs were sufficient for shipping PWR and BWR fuel assemblies with average burnups of up to 55,000 MWD/MTU and 50,000 MWD/MTU, respectively. The final area was a burnup meter development and qualification, which included preliminary engineering analysis, prototype design procurement, manufacture and checkout, and an onsite demonstration.

49771 **(DOE/ET/34015—8) Evaluation of on-line chelant addition dilute chemical cleaning. Final report.** Swan, F.E. Jr; Schneidmiller, D.; Tvedt, T.J. (Commonwealth Research Corp., Chicago, IL (USA)). Dec 1983. Contract AC02-79ET34015. 173p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE85001443.

The on-line addition of chelants (EDTA, HEDTA) was evaluated based on thermostability of the metal chelate at steam generator operating conditions and based upon material compatibility. Testing under prototypical operating conditions in a model steam generator demonstrated the feasibility of this process under various fouling conditions (seawater and freshwater). Application of dilute chemical cleaning to steam generators was also evaluated. Feasibility of this process was demonstrated by its ability to clean packed crevices. However, application times are long and corrosion rates, while acceptable, require additional development of non-sulfur containing inhibitors.

49772 (INIS-mf—8881, pp vp) **Pressurized thermal shock program sponsored by EPRI.** Stahlkopf, K.E. (Electric Power Research Inst., Palo Alto, CA (USA)). 1983. NTIS (US Sales Only), PC A22/MF A01. File Number TI84780610. (CONF-8310224—).

From MPA seminar on safety of light water reactor pressure vessels; Stuttgart, F.R. Germany (13 Oct 1983).

This paper is enclosed separately.

The potential for long term neutron embrittlement of reactor vessels has been recognized for a number of years. Reactor vessel thermal shock is not a new concern, but with a growing number of plants approaching their mid-lives, it is a concern that must be understood and dealt with. Recent attention has focused on the performance of vessels during overcooling transients. This concern was designated as Unresolved Safety Issue A-49 by the Nuclear Regulatory Commission in December 1981. The USNRC staff has identified eight overcooling events of concern in U.S. PWRs. The concern is currently limited to Pressurized Water Reactors. The Electric Power Research Institute (EPRI) has supported research on reactor vessel integrity for a number of years and has supported an extensive effort on reactor vessel pressurized thermal shock (PTS) over the last three years. In addition, EPRI has developed a linked set of computer codes to simulate the pressurized thermal shock transients and assess the integrity of the nuclear reactor vessels for various overcooling transients. This paper focuses on the integrated analysis approach being used by EPRI in performing such analysis.

49773 (INIS-mf—9036, pp 843-849) **Control and evaluation part of equipment for testing WWER 440 pressure vessels.** Skala, Z. (Skoda, Plzen (Czechoslovakia). Zavod Energeticke Strojirenstvi). 1982. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number TI85780006. (CONF-8206259—Vol.4).

From Autos 82 - Automation in engineering meeting; Plzen, Czechoslovakia (15 Jun 1982).

The equipment for the in-service materials testing of pressure vessels consists of a manipulator, a modular ultrasound instrument - the TRC 8000, a system for drive control and for position indication and a system for data collection and processing. Ultrasound probes scan the surface of the tested material and the resulting signal is processed together with the information on the position of the probe. The system of data collection and processing processes from the measured data the durable records in the form of videorecordings, printouts and linear and x-y recorder graphics. The movement of the manipulator is microcomputer controlled. A simplified diagram illustrates the links between the data processing system components.

49774 (INIS-mf—9039, pp 476-482) **Reliability analysis of selected systems of nuclear power unit.** Chvalova, J.; Turnik, S.; Stekl, J. (Skoda, Prague (Czechoslovakia). Zavod Vystavby Elektraren). 1982. (In Czech). NTIS (US Sales Only), PC A03/MF A01. File Number TI85780003. (CONF-8206259—Vol.3).

From Autos 82 - Automation in engineering meeting; Plzen, Czechoslovakia (15 Jun 1982).

The reliability analysis is discussed of selected facilities of the 440 MW nuclear power unit using the failure tree method. The first part of the paper deals with the primary circuit and analyses the possibility of a dangerous failure arising of the system of accident alarm of the first order of the WWER 440 nuclear reactor during the event of the "outage of four and more circulating pumps". The second part of the paper is related to the secondary circuit. It studies the causes and probabilities of the failures of functions of condensate flow pumping and control with regard to the event the "turbogenerator failure".

49775 (INIS-mf—9052, pp 22) **Physical and mathematical models and computer codes for global reactor calculations of WWER.** Apostolov, T.; Manolova, M.; Petkov, P.; Prodanova, R. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). 1983. (In Bulgarian). NTIS (US Sales Only), PC A99/MF A01. File Number TI84780548. (CONF-8309253—Absts.).

From 1. national congress of the physicists in Bulgaria; Sofia, Bulgaria (28 Sep 1983).

Published in summary form only.

49776 (INIS-mf—9052, pp 38) **Fixed in-core detector reading analysis.** Velkov, K.; Kolev, N.; Ovcharova, Zh.; Kaschiev, G. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). 1983. (In Bulgarian). NTIS (US Sales Only), PC A99/MF A01. File Number TI84780548. (CONF-8309253—Absts.).

From 1. national congress of the physicists in Bulgaria; Sofia, Bulgaria (28 Sep 1983).

Published in summary form only.

49777 **(KFKI—1983-127) Simulation of the dynamic behaviour of the primary circuit in a WWER-440 type nuclear power plant Pt. 1.** Kolev, N.P.; Janosy, J.S. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Dec 1983. 48p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84703156.

This report reflects the present status of a dynamic simulation model of the primary circuit of a WWER-440 type nuclear power plant. This simulation has been carried out as a cooperation between INRNE, Sofia and KFKI, Budapest. The fundamental goals are to test the existing control and safety system and to check different new control concepts by simulating normal and accidental transients. The first part describes the models of the main technological units and the simulation tools. In the second part the models of the control and safety systems are presented, then some developed versions of the technological units are discussed. Finally, some simulation results are also presented.

49778 **(ZfK—522) Performance analysis of VVER-type fuel rods with the STOFFEL-1 computer code.** Reinfried, D.; Steinkopff, H. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Mar 1984. 9p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703155.

The main features of the fuel rod performance modelling computer code STOFFEL-1 are described. Submodels of the code are briefly characterized, and some results of comparisons between model predictions and experiments are presented. Examples of modelling calculations are given for some thermo-mechanical values of VVER-1000 fuel rods.

2103 Power Reactors, Non-breeding, Graphite Moderated

REFER ALSO TO CITATION(S) 2103049860, 50117

49779 **(CONF-711173—Exc.) Technical papers presented at the thirteenth Dragon Countries physics meeting.** (Organization for Economic Co-Operation and Development, Winfrith (UK). High Temperature Reactor Project). 1971. 102p. NTIS (US Sales Only), PC A06/MF A01. File Number DE84901524.

From 13. Dragon Countries physics meeting; Paris, France (18 Nov 1971).

Papers on HTGR type reactors are presented concering burnable poisons; control rod worths; fuel management; fuel element burnup; and reactor kinetics.

49780 **(Juel—1893) Effective thermal conductivity in packed beds of spheres especially in the core of a high temperature reactor.** Barthels, H.; Schuerenkraemer, M. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorbauelemente). Feb 1984. 51p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE84752159.

Cell and quasihomogeneous models for determining of the effective thermal conductivity in packed beds are compared and their evidence is investigated by own experimental data both in the high and low temperature range under consideration of the stationary fluid. The quasihomogeneous model is extended to packed beds with spheres of relatively low thermal conductivity. The void radiation heat transfer is considered theoretically and is determined experimentally. Simplified formulas are presented for the computation

of the effective thermal conductivity on the core of a high temperature reactor within a temperature range of 2500°C.

2104 Power Reactors, Non-breeding, Otherwise Moderated Or Unmoderated

49781 (PINSTECH/NED—105) Approach to neutronics analysis of CANDU reactors. Gul, S.; Arshad, M. (Pakistan Inst. of Nuclear Science and Technology, Rawalpindi. Nuclear Engineering Div.). Dec 1982. 27p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84703149.

An attempt is made to tackle the problem of neutronics analysis of CANDU reactors. Until now CANDU reactors have been analysed by the methods developed at AECL and CGE using mainly receipe methods. Relying on multigroup transport codes GAM-GATHER in combination with diffusion code CITATION a package of codes is established to use it for survey as well as production purposes.

2105 Power Reactors, Breeding

REFER ALSO TO CITATION(S) 21050049791, 49849, 49862, 49882, 49884, 49892, 49893

49782 (CONF-840901—15) Status of nuclear data of importance for LMFBR applications prior to the evaluation of ENDF/B-VI. Poenitz, W.P. (Argonne National Lab., Idaho Falls, ID (USA)). 1984. Contract W-31-109-ENG-38. 20p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000071.

From ANS topical meeting on reactor physics and shielding; Chicago, IL, USA (17 Sep 1984).

The evaluation of nuclear data of importance to the LMFBR program has shifted to a Nuclear Data Evaluation Task Force. It is anticipated that the results of these evaluations will be incorporated in ENDF/B-VI. However, several cross sections for reactor applications are included in a simultaneous evaluation of the standard cross sections for ENDF/B-VI organized by the Standard Subcommittee of CSEWG. Cross sections included in this simultaneous evaluation are those of $^{6}Li(n,\alpha)$, $^{6}Li(n,n)$, $^{10}B(n,\alpha_0)$, $^{10}B(n,\alpha_1)$, $^{10}B(n,n)$, $^{197}Au(n,\gamma)$, $^{235}U(n,f)$, $^{238}U(n,\gamma)$, $^{238}U(n,f)$, and $^{239}Pu(n,f)$. The change of the evaluation methodology for ENDF/B-VI will result in a much improved definition of the data, their uncertainties and cross correlations. Trends which can be seen in new data and which are caused by the change of the evaluation procedure are toward, lower $^{239}Pu(n,f)$, $^{235}U(n,\gamma)$, modestly lower $^{235}U(n,f)$, and higher $^{10}B(n,\alpha)$ data. The data base for $^{238}U(n,\gamma)$ below 30 keV remains poorly defined and a resolution of the C/E discrepancy of C^{25}/F^{49} cannot be expected from the infinite dilute capture cross section of ^{238}U. Anti nu of ^{252}Cf remains unchanged and therefore also the nu(E) of the fissile isotopes, except at thermal energy.

49783 (ECN—155) Fast reactor programme. Annual progress report 1982. Plakman, J.C. (Netherlands Energy Research Foundation, Petten). 1984. 114p. NTIS (US Sales Only), PC A06/MF A01. File Number DE84703158.

The status of recent fast-capture cross sections for important fission-product nuclides has been reviewed; an intercomparison of evaluations for Eu-isotopes has been made and corrections have been applied to recent reported evaluations of neutron capture cross sections for Pd isotopes. An outline of the evaluation procedure for the nuclides sup(58g)Co and sup(58m)Co is given. The evaluation of the cover-gas nuclides has been completed with additional results for ^{36}Ar and ^{38}Ar. Some results of the latest fuel failure experiments under simulated reduced coolant conditions, the so-called SHOT experiments, are given. The first irradiation experiments with the prototype irradiation facility HFR-TOP 01 are described. Neutron flux calculations have been performed to determine the dimensions of a flux depression plate to achieve a symmetric flux distribution inside the fuel during pre-irradiation. The creep investigations on various heats and welded joints of DIN 1.4948 have been finished; the main findings are reported. A first project on the low-cycle fatigue behaviour of DIN 1.4948 has been completed. A three-dimensional finite element analysis has been performed on compact tension test specimen having a curved crackfront due to crack-tunneling. A code version of the VITESSE computer code has been developed to predict the thermohydraulic behaviour of distorted bundle geometries. Results from the LDA measuring programmes in the different test sections with respect to the secondary flow velocities are reported. Noise measurements in an unblocked 60 deg. reference bundle have been performed.

2106 Power Reactors, Auxiliary, Mobile, Package, And Transportable

REFER ALSO TO CITATION(S) 21060049817

49784 (GEMP—395) 710 reactor program. Progress report No. 17. (General Electric Co., Cincinnati, OH (USA). Nuclear Materials and Propulsion Operation). 1 Dec 1965. 66p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE84017121.

This report is the seventeenth in a series of progress reports of the advanced high-temperature gas reactor - 710 program. This report describes the work performed and progress made from September 1 to October 31, 1965 on the following current tasks in the 710 program: Development of Refractory-Metal Fuel Elements; Critical Experiments of Fast-Spectrum, Refractory-Metal Reactors; Experimental Reactor Preliminary Design and Development; Test Facilities Design and Evaluation; and Investigations of the Application of the 710 Reactor Concept to Space Power Systems.

2107 Regulation And Licensing

49785 (NUREG—0750-Vol.19-No.5) Nuclear Regulatory Commission issuances. Vol. 19, No. 5. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Technical Information and Document Control). May 1984. 177p. NTIS, PC A09/MF A01 - GPO*. File Number TI85900022.

This report includes the issuances received during the specified period from the Commission (CLI), the Atomic Safety and Licensing Appeal Boards (ALAB), the Atomic Safety and Licensing Boards (LBP), the Administrative Law Judge (ALJ), the Directors' Decisions (DD), and the Denials of Petitions for Rulemaking (DPRM).

49786 (NUREG—0750-Vol.19-No.6) Nuclear Regulatory Commission issuances, June 1984. Volume 19, No. 6. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Technical Information and Document Control). Jun 1984. 289p. NTIS, PC A13/MF A01 - GPO*. File Number TI85900266.

This report includes the issuances received during the specified period from the Commission, the Atomic Safety and Licensing Appeal Boards, the Atomic Safety and Licensing Boards, the Administrative Law Judge, the Directors' Decisions, and the Denials of Petitions for Rulemaking.

49787 (NUREG/CR—3899) Utility financial stability and the availability of funds for decommissioning. Siegel, J.J. (Engineering and Economics Research, Inc., Vienna, VA (USA)). Sep 1984. 24p. NTIS, PC A02/MF A01 - GPO* $3.25. File Number TI85900021.

The NRC is currently developing rulemaking in the area of decommissioning nuclear facilities. A part of that rulemaking effort is assuring that funds will be available at the time of decommissioning of power reactors. Previous NRC reports have examined this issue by studying various funding methods. This report provides an update by analyzing the relative level of assurance of funding methods, considering the present utility financial situation. In its analysis the report makes use of specific case situations. The report concludes that the various funding methods studied in the earlier reports including the internal reserve method provide assurance of the availability of funds for decommissioning.

49788 **(REG/G—1.89-Rev.1) Environmental qualification of certain electric equipment important to safety for nuclear power plants. Rev. 1.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research). Jun 1984. 18p. NTIS, PC A02/MF A01 - GPO*. File Number TI84901580.

This regulatory guide describes a method acceptable to the NRC staff for complying with 50.49 of 10 CFR Part 50 with regard to qualification of electric equipment important to safety to service in nuclear power plants to ensure that the equipment can perform its safety function during and after a design basis accident.

49789 **(STI/DOC—10/237) Manual on quality assurance programme auditing.** (International Atomic Energy Agency, Vienna (Austria)). Jul 1984. 157p. UNIPUB, P.O. Box 433, Murray Hill Station, New York, NY 10157. File Number TI85900031.

The IAEA Code of Practice on Quality Assurance for Safety in Nuclear Power Plants, hereafter referred to as the Code, establishes requirements for implementing a system of planned and documented internal and external audits to verify compliance with all aspects of a quality assurance (QA) program and to determine its effectiveness. These requirements are further elaborated in the Safety Guide on Quality Assurance Auditing for Nuclear Power Plants (IAEA Safety Series No. 50-SG-QA10), which contains requirements and recommendations on the management, preparation and performance of QA program audits. The objective of this Manual is to provide guidance and illustrative examples of the methodology and techniques of internal and external audits that are consistent with the requirements and recommendations of the Code and the Safety Guide. The methodology and techniques are based on the practices of Member States having considerable experience in auditing QA programs. This Manual is directed primarily towards QA program auditors and managers and presents methods and techniques considered appropriate for the preparation and performance of audits and the evaluation of results. Its scope includes the techniques and methods used to carry out QA program audits variously described as System, Product and Process audits.

2108 Economics

REFER ALSO TO CITATION(S) 21080049787, 49934

49790 (CONF-830179—Vol.2, pp 27p, Paper 6) **Civilian uses of nuclear power: status and future.** Agnew, H.M. (GA Technologies Inc., San Diego, CA). 1983. D. File Number TI84901918.

From Energy: challenges and opportunities for the Middle Atlantic United States symposium; Baltimore, MD, USA (10 Jan 1983).

Information is presented concerning the current contribution of nuclear energy; resource utilization; current issues of economics, safety, wastes, proliferation, and energy policy; needs for the future; and development of HTGR type reactors for second generation nuclear technology.

49791 **(DOE/NE—0059) Technical reference book for the Energy Economic Data Base (EEDB) Program.** Allen, R.E.; Benedict, R.G.; Hodson, J.S. (United Engineers and Constructors, Philadelphia, PA (USA). Advanced Engineering Dept.). Sep 1984. Contract AC05-84OR21400. 390p. NTIS, PC A17/MF A01; 1; GPO Dep. File Number DE84017643.

The Energy Economic Data Base (EEDB) Program is sponsored by the US Department of Energy (DOE) for the purpose of developing current technical and cost information for nuclear and comparison electric power generating stations. The EEDB contains a variety of nuclear and coal-fired power plant technical data models. Each of these data models is a complete and detailed conceptual design for a single unit, commercial, steam electric, power generating station located on a standard hypothetical Middletown site. A major effort for the Sixth Update (1983) has been the updating of the system design descriptions and selected engineering drawings for the technical data models. This update took the form of revising and expanding the system design descriptions and engineering drawings contained in the Base Data Studies, to include the technical information developed and recorded in the first five EEDB updates. The results of the update effort are contained in this EEDB Program Technical Reference Book.

49792 **(GAO/RCED—84-27) Status of Bonneville Power Administration's efforts to improve its oversight of three nuclear power projects.** Bowsher, C.A. (General Accounting Office, Washington, DC (USA). Office of the Comptroller General). 3 Aug 1984. 64p. General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760. File Number TI85900095.

In the early 1970's, the Department of Energy's Bonneville Power Administration acquired all or part of the power-generating capability of three nuclear projects being constructed in the Pacific Northwest by the Washington Public Power Supply System. Under its contracts with the Supply System, Bonneville has certain oversight rights and responsibilities to help ensure that the plants are constructed and operated in an efficient manner. GAO found that Bonneville had improved it oversight efforts since a 1979 GAO review. For example, agreements between Bonneville and the Supply System improved Bonneville's ability to access key project information. In late 1983, as GAO was completing its field work, Bonneville restructured its oversight organization and formed a top management steering committee to coordinate its oversight programs. While GAO agrees that Bonneville has taken positive steps to improve its oversight efforts, additional steps are needed. In particular, Bonneville needs to develop roles, policies, and procedural statements which clearly and specifically define the interrelationships and responsibilities of the various groups at Bonneville involved with oversight. Bonneville should then review the adequacy of oversight staffing against its defined oversight responsibilities.

49793 **(GRS-A—757) Safety strategy for the use of plutonium.** Thomas, W.; Brenig, H.; Haider, G.; Hesse, U.; Mueller, W.; Wurtinger, W. (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Garching (Germany, F.R.)). Sep 1982. vp. (In German). Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Garching (Germany, F.R.).

The amount of plutonium produced is estimated. A survey of fuel cycles employed to date and of the use of plutonium is set up. The existing safety analyses are registered and characterized. Possible fuel cycle alternatives are registered, the state-of-the-art in the various fuel cycle concepts are examined, intervention of third parties and subnational deviation are discussed.

49794 **(Juel-Spez—223) Electricity production cost in coal and nuclear power plants.** Sievert, D.; Pohlmann, M.; Hildebrandt, T.; Manthey, C.; Moenig, W. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Programmgruppe Systemforschung und Technologische Entwicklung). Sep 1983. 59p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE84751928.

This study aims at comparing three recently published studies on electricity production cost in coal and nuclear power plants in as brief and neat a form as possible. While doing so, assumption and results of the studies are contrasted, individual important parameters are discussed and the methodology applied is analysed. In addition, some thought is given to investment calculations under aspects of system analysis. The selection of the studies was based on the following items: The number of studies was to be small for reasons of neatness and clarity but they were to cover the whole range of data and assumptions and they were to be as up-to-date as possible. The following studies were selected accordingly: 1. "The end of cheap nuclear electricity" by Juergen Franke and Dieter Viefhues ("Eco"-study"). 2. "Nuclear energy and profitability" by Ulf Hansen. 3. "Parameter study for establishing the cost of electricity production from black coal and nuclear energy" by Dieter Schmitt, Herbert Junk, Karl.-F. Ebersbach, Heinrich Prechtl.

2109 Process Heat Reactors

49795 (CONF-840905—1) National need for utilizing nuclear energy for process heat generation. Gambill, W.R.; Kasten, P.R. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001108.

From Joint power generation conference; Toronto, Canada (30 Sep 1984).

Nuclear reactors are potential sources for generating process heat, and their applications for such use economically competitive. They help satisfy national needs by helping conserve and extend oil and natural gas resources, thus reducing energy imports and easing future international energy concerns. Several reactor types can be utilized for generating nuclear process heat; those considered here are light water reactors (LWRs), heavy water reactors (HWRs), gas-cooled reactors (GCRs), and liquid metal reactors (LMRs). LWRs and HWRs can generate process heat up to 280°C, LMRs up to 540°C, and GCRs up to 950°C. Based on the studies considered here, the estimated process heat markets and the associated energy markets which would be supplied by the various reactor types are summarized.

22 NUCLEAR REACTOR TECHNOLOGY

2201 Theory And Calculation

REFER ALSO TO CITATION(S) 22010049884

49796 (BMI—1983-026) Criticality experiments of the years 1981 and 1982. Heinicke, W.; Tischer, A. (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Garching (Germany, F.R.); Bundesministerium des Innern, Bonn (Germany, F.R.)). Dec 1983. 21p. (In German). (GRS-A—863). NTIS (US Sales Only), PC A02/MF A01. File Number DE84751525.

This report presents a collection of published criticality experiments made in 1981 and 1982 and thus continues the collection of experimental data of this type commenced with the GRS report A-644 of November 1981, which covers criticality experiments of the years 1975 to 1980. The report gives the main data of about 30 publications which, just a those cited in the GRS report, can be retrieved from the improved KRITEXP data base using 14 index terms, and printed out at random sequence. The collection of experimental data is of particular value with regard to the licensing of all installations forming part of the nuclear fuel cycle, which is subject to the atomic energy law and requires the verification of computed criticality analyses by experimental data.

49797 (CONF-840902—10) LSL-M1 and LSL-M2: two extensions of the LSL adjustment procedure for including multiple spectrum locations. Stallmann, F.W. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001545.

From 5. ASTM-Euratom symposium on reactor dosimetry; Geesthacht, F.R. Germany (24 Sep 1984).

Most current adjustment procedures, including LSL, can adjust only one spectrum with dosimetry located at the point of the input spectrum. Many radiation experiments have dosimetry at more than one location, and fluence or damage exposure values are desired for locations other than those covered by dosimetry. Thus, the use of single-spectrum dosimetry to these experiments causes considerable loss of information and introduces large uncertainties. Two extensions of the LSL code to cover multiple-spectra adjustment are discussed. Each extension has different restrictions and covers a different range of applications.

49798 (IKE—4-113) Method for convergence acceleration of iterative solutions of eigenvalue-problems in reactor theory and implementation in the DIFGEN-code. Pflueger, H.; Mayer, P.; Schmidt, F. (Stuttgart Univ. (Germany, F.R.). Inst. fuer Kernenergetik und Energiesysteme). Jun 1983. 100p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE84751929.

In this work the iterative solution of eigenvalue problems in the field of reactor physics is discussed. Algorithms are described together with a study of the convergence properties of problems with and without upward scattering. In addition the commonly used methods for convergence acceleration are presented with the corresponding regions of applicability and their possible combinations. Some of these methods and combinations of them are implemented into the DIFGEN-program, and a new method is presented for convergence acceleration in the initial phase. The Wielandt iteration is applied to the algorithm for the first time, as well as most of the combinations coded in this work. The convergence acceleration methods are tested using five examples, together with an automatic procedure to select a suitable acceleration method for a given problem.

49799 (INIS-mf—9052, pp 23) Efficient numerical methods for analysis of nuclear reactor thermohydraulics. Kolev, N.; Velkov, K.; Nankov, N. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika); Katkovskij, E. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Ehlektromekhaniki, Moscow (USSR)). 1983. (In Bulgarian). NTIS (US Sales Only), PC A99/MF A01. File Number TI84780548. (CONF-8309253—Absts.).

From 1. national congress of the physicists in Bulgaria; Sofia, Bulgaria (28 Sep 1983).

Published in summary form only.

49800 (Juel—1888) Installation of a three-dimensional simulation method for core-physical description of pebble bed reactors with multiple recycling process at the example of the AVR. Grotkamp, T. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung; Technische Hochschule Aachen (Germany, F.R.)). Jan 1984. 85p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE84751924.

To describe the core-physical behaviour of pebble bed reactors simulation models are used, which reproduce the burn-up/recycling and - resulting - calculate criticality and neutron spectrum as well as neutron flux and temperature distribution. Modelling the AVR-reactor requires a three-dimensional treating for detailed considerations because of the graphite noses extending into the core. Such a system is built up in the present work and compared with the results of the two-dimensional model standardized from operational side. The agreement is so good that the latter one is sufficient for the calculations accompanying the operation. The comparison with results of measurement is very satisfying in regard to fuel element distribution and temperature coefficient. As in all theoretical investigations there remains a discrepance of a little more than 1 nile against the measurement at the reactivity equivalence of the AVR rod-bank. On the other hand it is possible to reproduce the rod-bank curve resulting of the calibration very exactly with the present model.

49801 (ORNL/CSD/TM—210) SKINATH - a computer program for solving the reactor point kinetics equations with simple thermal-hydraulic feedback. Dodds, H.L. Jr.; Westfall, R.M. (Tennessee Univ., Knoxville (USA). Dept. of Nuclear Engineering; Oak Ridge National Lab., TN (USA)). Sep 1984. Contract AC05-84OR21400. 62p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85001491.

A FORTRAN computer program named SKINATH has been developed for solving the reactor point kinetics equations with simple thermal-hydraulic feedback. The program utilizes the ordinary differential equation solver, LSODE, developed by Hindmarsh at the Lawrence Livermore National Laboratory. Based on comparisons with both analytical and other numerical solution techniques, the program gives accurate results with impressively short run times.

2202 Components And Accessories

REFER ALSO TO CITATION(S) 22020050120, 50121, 50122, 50298, 50369, 50370, 50371, 50411

49802 **(CEGB-TPRD/B—0345/N83) Minimum critical crack depths in pressure vessels guidelines for nondestructive testing.** Crossley, M.R.; Townley, C.H.A. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Sep 1983. 24p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703150.

Estimates of the minimum critical depths which can be expected in high quality vessels designed to certain British and American Code rules are given. A simple means of allowing for fatigue crack growth in service is included. The data which are presented can be used to decide what sensitivity and what reporting levels should be employed during an ultrasonic inspection of a pressure vessel. It is emphasised that the minimum crack depths are those which would be relevant to a vessel in which the material is stressed to its maximum permitted value during operation. Stresses may, in practice, be significantly less than this. Less restrictive inspection standards may be established, if it were considered worthwhile to carry out a detailed stress analysis of the particular vessel under examination.

49803 **(EPRI-NP—3446) Evaluation of low-cobalt alloys for hardfacing applications in nuclear components. Final report.** Landerman, E.I. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Nuclear Energy Systems Div.). Aug 1984. 64p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920015.

The low- and no-cobalt alloys selected for this study were evaluated first based on weldability and metallurgical tests of hardfaced specimens prepared by the plasma transferred arc method. Wear and friction tests were then performed on these selected materials and comparisons were made with the currently used high-cobalt alloys. The low- and no-cobalt alloys showed significantly higher wear (based on weight loss) compared to the high-cobalt alloys at high loads when like materials were tested. When dissimilar combinations were tested, selected low- or no-cobalt alloys evaluated against the high-cobalt alloys showed wear properties equivalent to those observed in similar metal tests of the high-cobalt alloys at high loads. The coefficients of friction measured during these tests with several of the low- or no-cobalt alloys in similar metal and dissimilar metal combinations did not show significant differences from the coefficients of friction determined for the currently used high-cobalt alloys.

49804 (INIS-mf—8881, pp vp) **Crack growth under cyclic thermal shock loading.** Czuck, G.; Mattheck, C.; Stamm, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorbauelemente); Munz, D. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Inst. fuer Zuverlaessigkeit und Schadenskunde im Maschinenbau). 1983. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84780610. (CONF-8310224—).

From MPA seminar on safety of light water reactor pressure vessels; Stuttgart, F.R. Germany (13 Oct 1983).

A survey is given of the present state of investigations at Karlsruhe on the problem of thermal fatigue. In the experiment, particular stress is laid on the defined boundary and initial conditions: the measurement of thermal stress (temperature), the characteristics of the material conditions, the defined initial crack geometry, possible variations of experimental parameters by using small samples, sufficient simplicity for theoretical models, because of the complicated stress conditions.

49805 (INIS-mf—8881, pp vp) **Influence of material toughness on damage caused by thermal shock loading.** Jansky, J.; Foehl, J.; Sauter, A.; Iskander, S.K. 1983. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84780610. (CONF-8310224—).

From MPA seminar on safety of light water reactor pressure vessels; Stuttgart, F.R. Germany (13 Oct 1983).

The stressing of a pressure bearing component to be postulated as being cracked by a thermal transient is characterised by the fact that material toughness gradients caused by temperature gradients, radiation embrittlement and local reduction of toughness due to operating conditions and simultaneous stress gradients due to temperature distribution in the wall and the geometry of components are present. Previous experimental results show that in operating conditions similar to boiling water (high oxygen content in pressurised medium), one can expect a growth of existing surface faults through the plating into the ferritic wall, where the growth of cracks occurs mainly in the direction of wall thickness, as, due to negative stresses in the plating, only delayed extensions of cracks occur at the surface.

49806 (INIS-mf—8881, pp vp) **Some aspects on leak before break; their quantification and application.** Darlaston, B.J. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). 1983. NTIS (US Sales Only), PC A22/MF A01. File Number TI84780610. (CONF-8310224—).

From MPA seminar on safety of light water reactor pressure vessels; Stuttgart, F.R. Germany (13 Oct 1983).

Additional safety offered by a demonstration that a component will leak before failure is usually worth establishing. In some cases, this is still impossible, not because it is felt that the vessel will fail but that the pessimisms in the assessment route are too great. The crucial points which seem to be outstanding are: 1. The crack shape development due to load cycling; 2. The crack shape immediately following penetration; 3. The contribution of the tearing resistance of the material to increase the load carrying capacity of the component. The outstanding issues all appear to be linked to large scale testing and thus it is necessary to examine closely the rewards for such work. It could be argued in the author's personal view that if, at the design stage, leak before break cannot be demonstrated, then an alternative design should be introduced. However, this is not always feasible because of the pessimisms currently taken into the assessment. It is therefore necessary to examine the small number of important situations for which a better understanding of leak before break is desirable. By focussing on these specific issues, it may be possible to define programmes which will allow progress to be made. At present, it would seem that the many R and D programmes are aimed at the general rather than the specific issues.

49807 (INIS-mf—8881, pp vp) **Detection and analysis of residual- and loading stresses in thick-walled components. State of research and development of the nondestructive methods.** Hoeller, P.; Goebbels, K.; Schneider, E. (Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Saarbruecken (Germany, F.R.). Inst. fuer Zerstoerungsfreie Pruefverfahren). 1983. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84780610. (CONF-8310224—).

From MPA seminar on safety of light water reactor pressure vessels; Stuttgart, F.R. Germany (13 Oct 1983).

New methods for measuring the load and elastic strain conditions not only at the surface, but also inside the material using aids, such as are accepted and used in non-destructive testing for faults, have been designed and partly developed to a state which permits tests and the first applications. This article describes the present state as it affects the user and with particular consideration of work on ultrasonic and micro-magnetic processes.

49808 (INIS-mf—8881, pp vp) **Acoustic emission monitoring of ZB 1 intermediate scale vessel test.** Hutton, P.H.; Kurtz, R.J.; Pappas, R.A. (Battelle Pacific Northwest Labs., Richland, WA (USA)). 1983. NTIS (US Sales Only), PC A22/MF A01. File Number TI84780610. (CONF-8310224—).

From MPA seminar on safety of light water reactor pressure vessels; Stuttgart, F.R. Germany (13 Oct 1983).

Some key results are emerging from the ZB-1 test. A general observation is the fact that large scale testing is an invaluable step in perfecting a surveillance technique such as AE for use on operating plants. Many of the significant characteristics cannot be demonstrated using small scale laboratory specimens. Primary results derived to date from the 70°C portion of the testing include: Demonstration of the ability of AE to signal an impending failure condition; AE from fatigue crack growth can be consistently detected

using sensing methods directly applicable to reactor monitoring; Special features of the AE data such as signal amplitude produced by crack growth and the location of the AE data relative to the load cycle are becoming evident; The reliability of AE in detecting cracks during inservice hydrostatic testing is being defined; Use of AE data to estimate flaw severity appears to be feasible, and the pattern recognition method for identifying AE signals from crack growth must be improved by evidence indicates that it can be made to perform acceptably.

49809 (INIS-mf—8881, pp vp) **Application and evaluation of post-yield fracture mechanics concepts for cracked vessels.** Roos, E.; Kockelmann, H.; Stoppler, W. (Stuttgart Univ. (Germany, F.R.). Staatliche Materialpruefungsanstalt). 1983. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84780610. (CONF-8310224—).

From MPA seminar on safety of light water reactor pressure vessels; Stuttgart, F.R. Germany (13 Oct 1983).

The strength fracture concept R-curve method "two criteria process" and Battelle formulae were used on vessels with axial notches on the outer surface. The materials 20 Mn Mo Ni 55, 22 Ni Mo Cr 37 and X8 Ni 9 show notch impact strengths at the test temperature of 202J, 57J and 190J respectively. Apart from the R-curve method for the vessel made of the less tough material 22 Ni Mo G 37, the failure stresses were all calculated on the safe side. Except for the vessel made of X8 Ni 9, which represents the boundary case, the "large fracture" failure was correctly calculated. The use of the COD concept using the design curve for this vessel geometry is not possible. The correlation between widening at the base of the notch and at the vessel surface was determined by FE calculations. The modified COD concept gave a prediction of stresses at failure on the safe side.

49810 (INIS-mf—8881, pp vp) **New fabrication techniques for components-fabrication demands and in-service reliability.** Weiss, E.; Kessler, K.; Heidner, R. (Kraftwerk Union A.G., Erlangen (Germany, F.R.)). 1983. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84780610. (CONF-8310224—).

From MPA seminar on safety of light water reactor pressure vessels; Stuttgart, F.R. Germany (13 Oct 1983).

The above results show that the use of complex forgings and of L and Z shaped pipe sections represent a further step in the development of powerstation components, which guarantee correct manufacturing and test conditions regarding construction and which at the same time permit a reduction of the manufacturing and test costs. This trend is not limited to the exaples of forged prechamber and inductive bends of large diameter quoted, but is extended to parallel new or further developments, such as "liquid bulge" or liquid pressing processes for seamless T-pieces and liquid pressed armature housings and cold-formed bends with longer legs and fabricated cold bends in a larger range of dimensions. There are still extensive qualifications as regards fabricating conditions, heat treatment, mechanical-technological properties and corrosion, the results of which will be reported later.

49811 (INIS-mf—9039, pp 611-618) **Recording and evaluation of maintenance and repair jobs in nuclear power plants.** Kucera, J. (INORGA, Kosice (Czechoslovakia)). 1982. (In Slovak). NTIS (US Sales Only), PC A03/MF A01. File Number TI85780003. (CONF-8206259—Vol.3).

From Autos 82 - Automation in engineering meeting; Plzen, Czechoslovakia (15 Jun 1982).

Information is presented on the decomposition of the subsystem Maintenance of Nuclear Power Plant Facilities which is part of the researched Automatic System of Nuclear Power Plant Control. Detailed information is presented on the functional model Records and Evaluation of Maintenance and Repair Jobs in Nuclear Power Plants.

49812 (INIS-mf—9057) **Diagnostics of nuclear power plant components. Proceedings of a national seminar.** Pecinka, L. (ed.). (Ceskoslovenska Komise pro Atomovou Energii, Prague). 1982. 138p. (CONF-8111215—). NTIS (US Sales Only), PC A07/MF A01. File Number DE85780061.

From National seminar on diagnostics of nuclear power plant components; Zvikovske Podhradi, Czechoslovakia (22 Nov 1938).

Separate abstracts are presented for each of the papers included in the data base.

49813 (KFK—3470, pp 121-156) **Assessment of cracks in components of nuclear power plants.** Munz, D. Jan 1983. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number TI84751913. (CONF-821084—).

From Nuclear safety project annual colloquium; Karlsruhe, F.R. Germany (26 Oct 1982).

After a description of the general procedure for crack assessment tow special problems are treated more in detail, the thermal shock loading and the leak-before-break criterion. Problems for growth of surface cracks under thermal shock are high stress gradients, plastic deformation at the shocked surface and temperature dependence of the material properties. The main problem for the application of the leak-before-break criterion is again the prediction of the change in shape of the cracks, evaluation of critical crack sizes for local instability and for global instability and leakage areas and leak rates.

49814 (PNL-SA—11947) **Emerging technology of synthetic aperture focusing for ultrasonic testing.** Busse, L.J.; Doctor, S.R.; Collins, H.D. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1984. Contract AC06-76RL01830. 7p. (CONF-840647—29). NTIS (US Sales Only), PC A02/MF A01; 1; GPO Dep. File Number DE85000373.

From ASME pressure vessel and piping conference; San Antonio, TX, USA (17 Jun 1984).

The capabilities of synthetic aperture focusing techniques for ultrasonic testing (SAFT-UT) as a nondestructive testing technique are presented. SAFT-UT is a digital ultrasonic imaging method, which can be adapted to many different materials, specimen geometries, and wave propagation modes. The process allows each point within the inspected volume to be focused upon by mathematically simulating the action of a lens, specifically formed for imaging that point in the volume. All points are therefore imaged at the maximum available resolution. The PNL effort in SAFT-UT is a continuation of a program started earlier by the NRC at the University of Michigan. The objectives of the present program are: to engineer and evaluate a real-time flaw detection and imaging system based on SAFT-UT for inservice inspection of all required LWR components, to establish calibration and field test procedures, to demonstrate and validate the system through field reactor inspections, and (4) to gain ASME Code acceptance of the real-time SAFT-UT technique. The following aspects of SAFT-UT are presented in this paper: brief overview of SAFT imaging theory, results demonstrating achievable lateral resolution, and presentation of shear wave SAFT-UT images.

2203 Fuel Elements

REFER ALSO TO CITATION(S) 22030049896

49815 (FEI—1497) **To approximate thermal simulation of fuel rods with power peaking.** Mikhin, V.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1983. 14p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703153.

Assuming that axial heat flow-over can be neglected and that the coefficients of thermal conductivity are content the thermal conductivity problem is solved for fuel rods with an arbitrary cladding number and nonuniform heat release. The formula permitting to find the heat release law on the inner surface of the simulating pipe according to the preset heat release law of the simulated rod kernel are derived. The formulae relating the distributions of heat flux density and temperature on the rod surface are found. The boundary condition leading the problem of unstabilized heat exchange in rod bundles to the Cauchy problem is solved in the area occupied by the coolant.

49816 (NUREG/CR—3907) **GT2R2: an updated version of GAPCON-THERMAL-2.** Cunningham, M.E.; Beyer, C.E. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1984. Contract AC06-76RL01830. 95p. (PNL—5178). NTIS, PC A05/MF A01 - GPO $4.75. File Number TI85002085.

The GAPCON-THERMAL-2 code is used by the US Nuclear Regulatory Commission for audit calculations of nuclear fuel thermal performance computer codes. Since the code was originally written, errors and needed updates have been identified. Revision 2 of GAPCON-THERMAL-2 contains a number of coding corrections and updates, and now conforms with the American National Standards Institute FORTRAN-77 standard. The changes to the code are presented in detail. Benchmarking calculations, concentrating on fuel temperatures and fission gas release, were performed to qualify the effect of model changes on the performance of GAPCON-THERMAL-2, Revision 2. It was concluded that use of the old fuel relocation model combined with the modified ANS 5.4 fission gas release model provides the best overall comparison with the thermal performance and fission gas release data used for the benchmarking exercise. The use of the new fuel relocation model combined with the Beyer-Hann fission gas release model provided the best comparisons of thermal behavior but significantly underpredicted fission gas release.

2204 Control Systems

49817 (CONF-840113—9) **Instrumentation and Controls evaluation for space nuclear power systems.** Anderson, J.L.; Oakes, L.C. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 23p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000983.

From Symposium on space nuclear power systems; Albuquerque, NM, USA (10 Jan 1984).

Design of control and protection systems should be coordinated with the design of the neutronic, thermal-hydraulic, and mechanical aspects of the core and plant at the earliest possible stage of concept development. An integrated systematic design approach is necessary to prevent uncoordinated choices in one technology area from imposing impractical or impossible requirements in another. Significant development and qualification will be required for virtually every aspect of reactor control and instrumentation. In-core instrumentation widely used in commercial light water reactors will not likely be usable in the higher temperatures of a space power plant. Thermocouples for temperature measurement and gamma thermometers for flux measurement appear to be the only viable candidates. Recent developments in ex-core neutron detectors may provide achievable alternatives to in-core measurements. Reliable electronic equipment and high-temperature actuators will require major development efforts.

49818 (INIS-mf—9036, pp 796-802) **Spectral analyzer of vibroacoustic signals.** Prokop, K. (Energoinvest, Dukovany (Czechoslovakia). Zavod Jaderna Elektrarna); Karmasin, K. (Jaderna Elektrarna, Dukovany (Czechoslovakia)); Zahradka, I. (ORGREZ, Brno (Czechoslovakia)). 1982. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number TI85780006. (CONF-8206259—Vol.4).

From Autos 82 - Automation in engineering meeting; Plzen, Czechoslovakia (15 Jun 1982).

The spectral analyser is the basic component of the vibroacoustic diagnostic system of a PWR nuclear power plant. The combination of the analyser and a computer secures the automatic comparison of the spectra of measured signals to the reference spectrum. Two principal digital methods for real-time frequency analysis are recursive digital filtration and fast Fourier transformation. Analysers using the said two methods are characterized. The actual process of spectrum processing is computer controlled. The advantage of the analyser - computer combination is the possibility of maintaining a large bulk of valuable information and its effective processing and use for diagnostic purposes.

49819 (INIS-mf—9036, pp 661-666) **Control and testing unit for linear stepping drive of WWER 1000 reactor regulating rod.** Lnenicka, B.; Kocandrle, L.; Haniger, L. (Skoda, Plzen (Czechoslovakia). Zavod Energeticke Strojirenstvi). 1982. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number TI85780006. (CONF-8206259—Vol.4).

From Autos 82 - Automation in engineering meeting; Plzen, Czechoslovakia (15 Jun 1982).

The control unit is functionally divided into three parts: the logical control unit, the system of coil power supply units, the electronics of the position indicator. The basic demands on the unit and the description of the individual parts are presented.

49820 (INIS-mf—9036, pp 831-836) **Hybrid model of reactor neutron power control.** Sedlacek, J.; Mueller, V. (Skoda, Plzen (Czechoslovakia)). 1982. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number TI85780006. (CONF-8206259—Vol.4).

From Autos 82 - Automation in engineering meeting; Plzen, Czechoslovakia (15 Jun 1982).

The model is described of a neutron power controller implemented on the analog part of the EAI 690 hybrid computer system. The ARM-4 controller is designed for automatic control and stabilization of reactor power, for alleviating the reactor in case of the outage of the main circulating pump and for reducing reactor power. The system of accident protection for WWER 440 reactors is divided into four types: 1) the ARM controller is put out of operation and all the control assemblies fall by gravity, 2) the ARM controller is put out of operation and the control assemblies gradually fall by gravity, 3) the ARM controller is put out of operation and the assemblies gradually are inserted at a speed of 0.02 m/s, 4) the ARM controller is in operation and the upwards motion of the assemblies is blocked. The system of accident protection is simulated on the digital part of the hybrid EAI 690 computer system. An analog diagram of the ARM-4 and a block diagram of the accident protection of the reactor are given.

49821 (INIS-mf—9036, pp 692-698) **Measurement and evaluation system for in-core experiments.** Majer, J.; Smolik, J. (Skoda, Plzen (Czechoslovakia). Zavod Energeticke Strojirenstvi). 1982. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number TI85780006. (CONF-8206259—Vol.4).

From Autos 82 - Automation in engineering meeting; Plzen, Czechoslovakia (15 Jun 1982).

The system consists of three relatively self-contained units, viz., a measuring and evaluation unit covering the full range of measuring channels securing high accuracy of measurement at measurement rates of up to ca 10 Hz and allowing further processing according to computer programs; a measurement and evaluation unit covering a limited number of measuring channels at a rate of up to ca 100 kHz containing high-speed software for processing random signals and providing a sufficient memory capacity for data storage for later processing; a unit for simultaneous analog recording of several signals for later processing. DC signal components are measured and evaluated by the 3052A system by Hewlett-Packard. Pulse signal components and fast transient processes are measured and evaluated by the Fourier analyzer Plurimat-S 13. The system was tested in long-term operation at the Rheinsberg nuclear power plant.

49822 (INIS-mf—9036, pp 779-785) **Requirements for diagnostic measurement in pressurized water reactor nuclear power plants.** Prokop, K.; Hulin, J. (Jaderna Elektrarna, Dukovany (Czechoslovakia)). 1982. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number TI85780006. (CONF-8206259—Vol.4).

From Autos 82 - Automation in engineering meeting; Plzen, Czechoslovakia (15 Jun 1982).

The relationship is compared between standard instrumentation and the diagnostic system of a nuclear power plant with regard to purpose and measured variables. Measurement using standard instrumentation is not designed for monitoring of the state of the equipment although the waveform or immediate values of measured variables may help determine the origin of the failure. The continuous monitoring of the state of the system will be suitably served by

a diagnostic system which allows the recording of the occurrence and development of sudden failures on the basis of monitoring neutron noise, temperature fluctuation, pressure pulsations, vibrations and acoustic noises. The diagnostic system neither disturbs nor limits the operation of the standard instrumentation of the nuclear power plant with a PWR reactor.

49823 (INIS-mf—9037, pp 50-62) **Analysis of selected operating modes in WWER 440 nuclear power plants.** Bednarik, K.; Rubek, J.; Markvart, J.; Stirsky, P. (Vyzkumny Ustav Energeticky, Bechovice (Czechoslovakia)). 1982. (In Czech). NTIS (US Sales Only), PC A02/MF A01. File Number TI85780007. (CONF-8206259—Vol.1).

From Autos 82 - Automation in engineering meeting; Plzen, Czechoslovakia (15 Jun 1982).

Presented and analyzed are the results of control processes in operating modes of the jump reduction in the required turbine value by 5 and 10% Nsub(nom) and at the rapid reduction in reactor power by HO-III protection from rated power to 50% Nsub(nom). These modes are analysed from the point of view of the optimal choice of turbine power control (strengthening the proportional and integration channels). The influence is shown of these parameters on the course of the control process and recommendations presented for the suitable choice of their values.

49824 (INIS-mf—9039, pp 483-487) **Position measurement of reactor control rods in start-up experiments.** Icha, K. (Skoda, Plzen (Czechoslovakia). Zavod Energeticke Strojirenstvi). 1982. (In Czech). NTIS (US Sales Only), PC A03/MF A01. File Number TI85780003. (CONF-8206259—Vol.3).

From Autos 82 - Automation in engineering meeting; Plzen, Czechoslovakia (15 Jun 1982).

The technical design is described of the unit for measuring the positions of control rods of a WWER 440 nuclear reactor. The chosen principle, mechanical and electric concepts, construction and experience gained so far with the built unit are described.

49825 (INIS-mf—9052, pp 39) **Computer-aided core surveillance: a conceptual study for WWER type reactors.** Kolev, N.; Velkov, K.; Tomov, L. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). 1983. (In Bulgarian). NTIS (US Sales Only), PC A99/MF A01. File Number TI84780548. (CONF-8309253—Absts.).

From 1. national congress of the physicists in Bulgaria; Sofia, Bulgaria (28 Sep 1983).

Published in summary form only.

49826 (INIS-mf—9052, pp 21) **Non-sampling gamma-spectrometric analysis of IRT-2000 reactor coolant.** Uzunov, I.; Dermenzhiev, E.; Kalinkova, N.; Damyanov, B.; Dimov, K.; Velkov, K. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). 1983. (In Bulgarian). NTIS (US Sales Only), PC A99/MF A01. File Number TI84780548. (CONF-8309253—Absts.).

From 1. national congress of the physicists in Bulgaria; Sofia, Bulgaria (28 Sep 1983).

Published in summary form only.

49827 (NUREG/CR—3786) **Review of regulatory requirements governing control room habitability systems.** Jacobus, M.J. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1984. Contract AC04-76DP00789. 65p. (SAND—84-0978). NTIS, PC A04/MF A01 - GPO. File Number TI85000209.

This report reviews applicable guides, standards, and codes which govern the design, manufacture, selection, installation, and surveillance practices for components and systems important to control room habitability. It covers the fundamental guidance contained in General Design Criteria, Regulatory Guides, and applicable sections of the Standard Review Plan, as well as numerous documents referenced by this guidance. Instances are cited where the present guidance is misleading, contradictory, or vague. In some cases, the problems in the guidance result from inadequate technical bases; in other cases, the problems result from several documents which are not completely consistent. To independently assess the suitability of the regulatory guide which covers accidental chlorine releases, a computer program was developed to calculate chlorine concentrations in the control room following chlorine release. Although problems with the assumptions used to develop the guide were found, the conservative nature of the chlorine calculations appears to adequately compensate for these problems.

2205 Environmental Aspects

REFER ALSO TO CITATION(S) 22050050542

49828 (INIS-mf—9052, pp 32) **Results and conclusions from the radiation monitoring around the IRT-2000 nuclear reactor in Sofia for the 1962-1982 period.** Radicheva, M.; Mishev, I.; Bogoeva, L.; Apostolova, M; Khristova, B. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). 1983. (In Bulgarian). NTIS (US Sales Only), PC A99/MF A01. File Number TI84780548. (CONF-8309253—Absts.).

From 1. national congress of the physicists in Bulgaria; Sofia, Bulgaria (28 Sep 1983).

Published in summary form only.

49829 (INIS-mf—9052, pp 33) **Quantitative characteristics of the radiation background components in the Vitosha Mountain area and around nuclear reactor IRT-2000, Sofia.** Radicheva, M.; Shekherov, L.; Bogoeva, L.; Gelev, M.; Prodanov, N. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). 1983. (In Bulgarian). NTIS (US Sales Only), PC A99/MF A01. File Number TI84780548. (CONF-8309253—Absts.).

From 1. national congress of the physicists in Bulgaria; Sofia, Bulgaria (28 Sep 1983).

Published in summary form only.

49830 (INIS-mf—9052, pp 34) **Results and quantitative evaluations of the radionuclides and the level of the radiation background in Vitosha Mountain area and around the nuclear reactor IRT-2000, Sofia.** Radicheva, M.; Shekherov, D.; Prodanov, Ya.; Bogoeva, L.; Delcheva, D. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). 1983. (In Bulgarian). NTIS (US Sales Only), PC A99/MF A01. File Number TI84780548. (CONF-8309253—Absts.).

From 1. national congress of the physicists in Bulgaria; Sofia, Bulgaria (28 Sep 1983).

Published in summary form only.

49831 (INIS-mf—9052, pp 31) **Determination of the natural gamma background by means of TLD. Some results of the environmental monitoring around the IRT-2000 reactor in Sofia.** Gelev, M.; Radicheva, M.; Levi, S. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). 1983. (In Bulgarian). NTIS (US Sales Only), PC A99/MF A01. File Number TI84780548. (CONF-8309253—Absts.).

From 1. national congress of the physicists in Bulgaria; Sofia, Bulgaria (28 Sep 1983).

Published in summary form only.

49832 (UCRL-Trans—12012) **Method for treatment of wastewater of nuclear power plants.** Ito, Kazutoshi; Suzuki, Katsumi; Suzuki, Mamoru; Minato, Akira. (Lawrence Livermore National Lab., CA (USA)). [1984]. Contract W-7405-ENG-48. Translation of Japanese Patent No. Sho 56[1981]-82,497. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000238.

A method for treatment of wastewater of nuclear power plants is characterized by the fact that concentration and volume reduction are performed after Ca and Mg as components for the formation of an adhering scale is converted to an 8-oxyquinoline complex, which is hardly soluble in water, and does not precipitate out as an adhering scale, by the addition of 8-oxyquinoline into nuclear power plant wastewater.

2206 Research, Test, And Experimental Reactors

REFER ALSO TO CITATION(S) 22060049826, 49828, 49829, 49830, 49831, 49859, 49888

49833 (CONF-840902—11) ORNL evaluation of the ORR-PSF metallurgical experiment and blind test. Stallmann, F.W. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001546.

From 5. ASTM-Euratom symposium on reactor dosimetry; Geesthacht, F.R. Germany (24 Sep 1984).

A methodology is described to evaluate the dosimetry and metallurgical data from the two-year ORR-PSF metallurgical irradiation experiment. The first step is to obtain a three-dimensional map of damage exposure parameter values based on neutron transport calculations and dosimetry measurements which are obtained by means of the LSL-M2 adjustment procedure. Metallurgical test data are then combined with damage parameter, temperature, and chemistry information to determine the correlation between radiation and steel embrittlement in reactor pressure vessels including estimates for the uncertainties. Statistical procedures for the evaluation of Charpy data, developed earlier, are used for this investigation. The data obtained in this investigation provide a benchmark against which the predictions of the PSF Blind Test can be compared. The results of this investigation and the Blind Test comparison are discussed.

49834 (DOE/NBM—5001189) RERTR Program: goals, progress and plans. Travelli, A. (Argonne National Lab., IL (USA)). 25 Sep 1984. Contract W-31-109-ENG-38. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001189.

The status of the US Reduced Enrichment Research and Test Reactor (RERTR) Program is reviewed. After a brief outline of RERTR Program objectives and goals, program accomplishments are discussed with emphasis on the development, demonstration and application of new LEU fuels. Most program activities have proceeded as planned, and a combination of two silicide fuels (U_3Si_2-Al and U_3Si-Al) holds excellent promise for achieving the long-term program goals. Current plans and schedules project the uranium density of qualified RERTR fuels for plate-type reactors to grow by approximately 1 g U/cm³ each year, from the nearly null value of 1982 to the 7.0 g U/cm³ which will be reached in early 1989. The technical needs of research reactors for HEU exports are also estimated to undergo a gradual but dramatic decline in the coming years.

49835 (INIS-mf—9039, pp 519-524) **Computers in experimental nuclear power facilities.** Jukl, M. (Skoda, Plzen (Czechoslovakia)). 1982. (In Czech). NTIS (US Sales Only), PC A03/MF A01. File Number TI85780003. (CONF-8206259—Vol.3).

From Autos 82 - Automation in engineering meeting; Plzen, Czechoslovakia (15 Jun 1982).

The CIS 3000 information system is described used for monitoring the operating modes of large technological equipment. The CIS system consists of two ADT computers, an external drum store an analog input side, a bivalent input side, 4 control consoles with monitors and acoustic signalling, a print-out area with typewriters and punching machines and linear recorders. Various applications are described of the installed CIS configuration as is the general-purpose program for processing measured values into a protocol. The program operates in the conversational mode. Different processing variants are shown on the display monitor.

49836 (INIS-mf—9054) Annual report 1982-83. (Universities Research Reactor, Risley (UK)). 1983. 25p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85780008.

The operation and use of the reactor during 1982-3 is reported in detail. The research programme covers a wide range of projects in reactor and neutron physics and in radiochemistry and the application of radioisotopes. As well as university departments the reactor facilities are used by industrial firms. The activation analysis service is used mostly by industry. The gamma spectrometer used in this service needs replacing. The teaching and training programme has expanded to cater not only for undergraduate and postgraduate students but for in-service training of staff from the nuclear industry. The reactor use has been analysed and is tabulated. Reactor operation and site safety arrangements are reviewed including a listing of waste discharge and holdings of radioactive materials.

49837 (Juel—1889) Fundamentals for the evaluation of irradiation experiments on enrichment reduction in the FRJ-2 (AF-Programme). Borchardt, G.; Krug, W.; Weise, L. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Zentralabteilung Brennelement- und Bestrahlungstechnologie). Jan 1984. 35p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE84751919.

For the evaluation of irradiation experiments in the framework of the AF-Programme (Enrichment Reduction for Research Reactors) a computer code for the determination of burn-up was developed. The energy-integral cross-sections, which were needed for this purpose, have been determined appropriate to the specific problem in question. First results of an evaluation are reported in this paper.

49838 (ORNL/TM—9358) Bulk Shielding Facility. Quarterly report, January-March 1984. Corbett, B.L.; Lance, E.D. (Oak Ridge National Lab., TN (USA)). Oct 1984. Contract AC05-84OR21400. 21p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001700.

The BSR operated at an average power level of 1560 kW for 3.6% of the time during January, February, and March. Water-quality control in both the reactor primary and secondary cooling systems was satifactory. The PCA was used in training programs and was operated on thirteen occasions for university students to actively participate in training laboratories.

49839 (PINSTECH/NED—101) Mathematical formulation of temperature fluctuation and control rod vibration in PARR. Ansari, S.A.; Ayazuddin, S.K. (Pakistan Inst. of Nuclear Science and Technology, Rawalpindi. Nuclear Engineering Div.). [1984]. 37p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84703180.

This report describes the mathematical interpretation of experimental neutron noise spectra obtained for PARR core. A one dimensional thermal-hydraulic model of PARR core was developed to calculate the magnitude of neutron noise as a result of fluctuation in the core inlet coolant temperature. The sink structure of the neutron power spectral density as well as the dependence of observed neutron spectra on coolant velocity is also explained by the thermal hydraulic model. An attempt is made to explain the phenomena of control rod vibration by a simple eigen-frequency vibration model. The calculated neutron power spectral density due to vibration and temperature noise were added and compared with the experimental power spectra obtained for PARR.

49840 (SURRC—72/84) Scottish Universities Research and Reactor Centre, East Kilbride. Report on session 1982-1983. Wilson, H.W. (Scottish Universities Research and Reactor Centre, Glasgow (UK)). 1984. 47p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84703159.

The activities over the 1982-3 session are reviewed and all the research projects listed. These include reactor related activities (physics and radiochemistry, health physics and nuclear medicine and engineering), those of the isotope geology unit and NERC radiocarbon laboratory, the computing department and the teaching programme. The demand for irradiations, particularly for activation analysis has continued. There was no major maintenance shut-down in the year.

2207 Plutonium And Isotope Production Reactors

49841 (PINSTECH/NED—104) Benchmark calculations for MTR type cores. Arshad, M.; Gul, S. (Pakistan Inst. of Nuclear Science and Technology, Rawalpindi. Nuclear Engineering Div.). Nov 1982. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703160.

The benchmark neutronics design study of MTR cores has been performed for various fuel enrichments. The reactivities and fluxes for fresh core have been evaluated. The reference calculations have been performed for a 10MW(th) reactor but the method is applicable to other power levels. As the results are in good agreement with those obtained at other establishments, the method of analysis used in this report for a fresh core can be relied upon with a fair amount of confidence.

49842 **(PINSTECH/NED—110) Calculations of K with burn-up for various enrichments for MTR type core.** Bakhtyar, S. (Pakistan Inst. of Nuclear Science and Technology, Rawalpindi. Nuclear Engineering Div.). Jan 1983. 9p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703161.

The power research reactors utilized MTR-type fuel elements containing up to 20$ enriched uranium. Calculation of Ksub(eff) have been performed for various fuel enrichments and burn up levels of up to 20% for a 10 MW MTR type research reactor specified by an IAEA panel of experts. Results for high enrichment show close agreement while at low enrichment results need further improvement. The calculations for the integral parameter Ksub(eff) and the concentration of fission products at various burn up levels have been carried out for high 93%, intermediate 45% and low 20% enrichment.

2208 Propulsion Reactors

49843 **(FZA—25-123) System 125A: preliminary radiation effects analysis, (Tarpon) experimental airplane.** (General Dynamics Corp., Fort Worth, TX (USA). Convair Aerospace Div.). 15 Oct 1957. 124p. NTIS, PC A07/MF A01. File Number DE84901877.

Assuming a 50-h design goal for system design, and a 500-h design goal for airframe design, some of the systems contained within the Tarpon will fall short of their design goal; indeed primarily as a result of the extensive use of Teflon in the B-58 systems, some would malfunction after as little as one hour of nuclear flight. Systems which will require modification include the hydraulic system, pneumatic system, oil system, flight control system, and chemical engines.

49844 **(RN-FOP—0014) NERVA Program. Operating procedure: cart cooling system, Test Cell A.** (NERVA Test Operations, Jackass Flats, NV (USA)). 1 Sep 1963. 14p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017122.

The instructions described in this procedure are typical of the operation of Test Cell A relative to the KIWI-B4A. Operation of Test Cell A relative to the NRX reactor will require modifications dictated by specific test requirements. Under NRX conditions, it will be the responsibility of the test cell manager to evaluate the capabilities of Test Cell A in terms of given test requirements and then set forth detailed checklists which will be compatible with the test requirements.

2209 Reactor Safety

REFER ALSO TO CITATION(S) 22090049788, 49820, 50401, 50584, 50585, 50586

49845 **(BMI—1983-021) Benefit effort relation of sacrificial layers.** Reineke, H.H.; Hahn, K. (Bundesministerium des Innern, Bonn (Germany, F.R.)). Nov 1983. 78p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE84751539.

The facilities to influence the interaction between melt and the concrete foundation by a sacrificial layer was investigated by the help of the code SACRI. The results of this investigation show that a relative moderation of the course of the accident can be realized by a simple sacrificial layer. FeO or basalt are suitable sacrificial materials. On principle, the long-term embankment of the melt can be attaind with an insulating casing round the sacrificial bed. This measure would require a considerable effort and has an impact on the containment pressure.

49846 **(BMI—1983-022) HTCC - a heat transfer model for gas-steam mixtures.** Papadimitriou, P. (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Garching (Germany, F.R.); Bundesministerium des Innern, Bonn (Germany, F.R.)). Dec 1983. 102p. (In German). (GRS-A—849). NTIS (US Sales Only), PC A06/MF A01. File Number DE84751526.

The mathematical model HTCC (Heat Transfer Coefficient in Containment) has been developed for RALOC after a loss-of-coolant accident in order to determine the local heat transfer coefficients for transfer between the containment atmosphere and the walls of the reactor building. The model considers the current values of room and wall temperature, the concentration of steam and non-condensible gases, geometry data and those of fluid dynamics together with thermodynamic parameters and from these determines the heat transfer mechanisms due to convection, radiation and condensation. The HTCC is implemented in the RALOC program. Comparative analyses of computed temperature profiles, for HEDL Standard problems A and B on hydrogen distribution, and of computed temperature profiles determined during the heat-up phase in the CSE-A5 experiment show a good agreement with experimental data.

49847 **(BMI—1984-029) Investigation of the meltdown accident with special regard to the radiological state of knowledge.** Hassmann, K. (Bundesministerium des Innern, Bonn (Germany, F.R.). Abt. Reaktorsicherheit und Strahlenschutz; Kraftwerk Union A.G., Erlangen (Germany, F.R.)). Feb 1984. 122p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE84751524.

The distribution of fission products after a LOCA initiated melt-down accident has been calculated based on - thermodynamic computation with the KESS-system - release factors measured at the SASCHA facility of the KfK - prediction of aerosol depletion with the NAUA-3 code of the KfK. It has been shown that till the estimated failure of the containment by overpressurization 100 hours after the beginning of the accident nearly the total released aerosol mass is being depleted. Roughly 1 kg is released to the annulus by leakage, about 10 g will escape to the environment.

49848 **(CEGB-TPRD/B—0426/N84) Assessment of the radiological consequences of releases to groundwater following a core-melt accident at the Sizewell PWR.** Maul, P.R. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Mar 1984. 30p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84703138.

In the extremely unlikely event of a degraded core accident at the proposed Sizewell PWR it is theoretically possible for the core to melt through the containment, after which activity could enter groundwater directly or as a result of subsequent leaching of the core in the ground. The radiological consequences of such an event are analysed and compared with the analysis undertaken by the NRPB for the corresponding releases to atmosphere. It is concluded that the risks associated with the groundwater route are much less important than those associated with the atmospheric route. The much longer transport times in the ground compared with those in the atmosphere enable countermeasures to be taken, if necessary, to restrict doses to members of the public to very low levels in the first few years following the accident. The entry of long-lived radionuclides into the sea over very long timescales results in the largest contribution to population doses, but these are delivered at extremely low dose rates which would be negligible compared with background exposure.

49849 **(CONF-840901—16) Evaluation of the core physics and safety characteristics of a quasi-homogeneous LMFBR concept.** Khalil, H.; Yarlagadda, B.S. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000243.

From ANS topical meeting on reactor physics and shielding; Chicago, IL, USA (17 Sep 1984).

A core design concept utilizing two types of driver assemblies that differ in fuel pin diameter has been investigated as an alternative to the heterogeneous LMFBR core for achieving low

HCDA energetics. Core designs based on the (quasi-homogeneous) concept were developed and their performance compared to that of standard homogeneous and hetergeneous cores. It is shown that quasi-homogenous cores can be designed which possess many of the performance advantages of homogeneous cores (such as reduced power mismatches and local power swings), while retaining the potential safty advantages of heterogeneous cores (such as an incoherent response during loss-of-flow accidents and a reduced coolant void reactivity worth).

49850 **(CONF-841122—1) Water-level and fuel-failure external monitoring.** De Volpi, A. (Argonne National Lab., IL (USA)). 11 Apr 1984. Contract W-31-109-ENG-38. 3p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84011727.

From Symposium on new technologies in nuclear power plant instrumentation and control; Washington, DC, USA (28 Nov 1984).

The TMI-2 accident showed the need for better real-time knowledge of water level and coolant density in the core and downcomer. A gamma-ray hodoscope at a light-water reactor could consist of about 24 identical collimated detector modules vertically arranged in the air gap or biological shield outside the pressure vessel. Ten detectors at 120 cm vertical intervals would cover the full water height of a PWR. (DLC)

49851 **(CONF-841174—1) Design features to enhance debris bed coolability.** Gabor, J.D.; Cassulo, J.C.; Pedersen, D.R. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 4p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84014682.

From 5. information exchange meeting on debris coolability; Los Angeles, CA, USA (7 Nov 1984).

Ways to enhance debris bed dryout heat flux are being investigated. Sculptured layers of porous blocks of sintered shot on a cavity floor would provide an additional barrier against jet impact, aid in debris distribution, and provide additional low-resistance paths for vapor escape. Experiments were conducted by inductively heating a bed of stainless steel and nickel particles. Columns of glass balls were used for the vapor release paths. (DLC)

49852 **(CONF-841174—4) Geometric radiation exchange factors for axial radiative transfer in an LWR core filled with absorbing-emitting gases.** Chan, S.H.; Cho, D.H. (Wisconsin Univ., Milwaukee (USA). Dept. of Mechanical Engineering; Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 11p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002104.

From 5. information exchange meeting on debris coolability; Los Angeles, CA, USA (7 Nov 1984).

A reactor core filled with an emitting-absorbing mixture (like steam, hydrogen gas and fission gases) is considered. Analysis is provided to evaluate axial radiative heat exchange of a rod bundle with a nonuniform axial temperature distribution. The necessary radiation exchange shape factors (geometric mean absorptance, emittance and transmittance) between segments of the complex rod bundle arrangement are presented. They are applicable to arbitrary sizes of segments, well suited for numerical computations.

49853 **(CONF-8409112—3) Review of areas that may require simultaneous coupled solution of the thermal hydraulic and fission product/aerosol behavior equations for source term determination.** Kress, T.S. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 25p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001106.

From CSNI specialist meeting on aerosols in reactor safety; Karlsruhe, F.R. Germany (4 Sep 1984).

In the determination of the behavior of nuclear aerosols in the reactor coolant system and in the containment for the development of severe accident source terms, present practice generally is to first perform thermal hydraulic calculations for specific plant types and sequences and then to utilize the results as input for separate fission product/aerosol dynamic transport calculations. It is recognized that there are several areas in which the thermal-hydraulics and the fission product/aerosol behavior may be significantly coupled and that it is then basically incorrect to do the analyses in a separated manner. This review paper produces a speculative list of these potentially coupled areas and attempts to assess the importance of the coupling for as many of the specific items that time has allowed before this conference.

49854 **(EGG-M—08484) Raman and luminescence spectroscopy of zirconium oxide with the use of the MOLE microprobe.** Doyle, T.E.; Alvarez, J.L. (EG and G Idaho, Inc., Idaho Falls (USA)). 1984. Contract AC07-76ID01570. 13p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84017234.

Raman and luminescence spectroscopy with the use of the MOLE microprobe has been used to characterize ZrO_2 originating from oxidized fuel-rod cladding in nuclear accidents. Micro-Raman analysis of samples from Three Mile Island Unit 2 and the Power Burst Facility identified tetragonal and cubic ZrO_2. The tetragonal and cubic phases are high-temperature polymorphs of ZrO_2 and provide information about temperatures and hydrogen formation in the TMI-2 core. The data suggest that the tetragonal ZrO_2 in TMI-2 samples was stabilized by a crystallite size effect, whereas cubic ZrO_2 in PBF debris samples was stabilized by impurities. Luminescence was used to differentiate yttria-stabilized ZrO_2 ceramics and oxidized fuel-rod cladding in PBF debris samples. The ZrO_2 ceramics produced strong, sharp luminescence peaks which indicated the presence of titanium and yttria in the ZrO_2. Oxidized fuel-rod cladding displayed no luminescence.

49855 **(GAO/RCED—84-43) Further actions needed to improve emergency preparedness around nuclear powerplants.** Bowsher, C.A. (General Accounting Office, Washington, DC (USA). Office of the Comptroller General). 1 Aug 1984. 149p. General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760. File Number TI85900094.

Report to The Congress.

Since the Three Mile Island accident in 1979, state and local emergency planning and preparedness around nuclear powerplants have improved considerably under the leadership of the Federal Emergency Management Agency. All 54 operating nuclear powerplants sites have state and local offsite emergency preparedness plans. FEMA has formally approved 24 of these plans, but it does not anticipate approving the remaining plans before September 1985 primarily because they do not fully comply with FEMA's criteria. Progress has also been made in developing a federal plan for responding to all radiological emergencies. However, the plan being developed does not fully address the need for centralized federal agency control and coordination which special inquiry groups identified after the Three Mile Island accident. Although considerable progress has been made, GAO believes more can and should be done and makes several recommendations to improve preparedness for a nuclear powerplant accident. GAO also presents a matter for Congress to consider concerning the coordination of the federal response to a nuclear powerplant emergency.

49856 (INIS-mf—8881, pp vp) **Trends in the development of new pipe systems for power plants.** Schwarzbach, K. (Mannesmann Anlagenbau A.G., Duesseldorf (Germany, F.R.)). 1983. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84780610. (CONF-8310224—).

From MPA seminar on safety of light water reactor pressure vessels; Stuttgart, F.R. Germany (13 Oct 1983).

The necessity for saving money in the construction of nuclear power-stations while retaining the high safety standards reached, led to an increase in the safety of specifications for standardization measures in West Germany. The costs and times of the construction of pipework in nuclear powerstations can be seen and controlled by this method, which represents a system of critical dates and therefore critical costs in nuclear powerstation construction. Based on safe design, the construction of nuclear pipework will continue to offer opportunities for increasing efficiency, if a sufficient programme for the proper construction of the pipework exists and the existing experience of specialist firms in this field is used.

49857 (INIS-mf—8881, pp vp) **Detrimental effects of subsequent increases in the safety and quality requirements using the Grohnde nuclear power station as an example.** Boettcher, D. (Preussische Elektrizitaets-A.G. (Preussenelektra), Hannover (Germany, F.R.)). 1983. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84780610. (CONF-8310224—).

From MPA seminar on safety of light water reactor pressure vessels; Stuttgart, F.R. Germany (13 Oct 1983).

The excellent operational availability and freedom from faults of German nuclear powerstations should give one the courage to take further sensible steps. From the operator's view these include: - Refusal to accept backfitting to a different state of science and technology. Instead of this, orderly introduction of new solutions after careful testing, unless meeting an emergency requires immediate action. - Further support of efforts at standardization of the industry with the possibility of transferring experience. - Reducing multiple inspections (the previous occurrence of multiple inspections in manufacture and erection in a system hides the danger of routine and creeping delegation of responsibility and attention among those concerned). - Limiting the extent of structural and repeat tests to the essential minimum, particularly where there are hold-ups caused during manufacture and erection, which prevent optimum economic construction. - Dispensing with complete documentation of every activity by the applicant, manufacturer, authority and expert. This may contribute to providing proofs for legal processes, but does not contribute to obtaining greater safety.

49858 (INIS-mf—9039, pp 556-564) **Automatic construction of failure tree for reliability analysis of nuclear power plants.** Kovacs, Z. (Vyskumny Ustav Energeticky, Bratislava (Czechoslovakia)). 1982. (In Slovak). NTIS (US Sales Only), PC A03/MF A01. File Number TI85780003. (CONF-8206259—Vol.3).

From Autos 82 - Automation in engineering meeting; Plzen, Czechoslovakia (15 Jun 1982).

A modified version of the CAT computer program is used for the computer-aided construction of the failure tree. The method is described of modelling the elements of the system using truth tables. The methodology is briefly outlined of the construction of the failure tree and an example is given of the application of the method in the mathematical modelling of the failure tree of the logical channel of the reactor protection system.

49859 (INIS-mf—9039, pp 624-631) **Reliability analysis of LR-0 reactor accident alarm system.** Kuklik, B.; Kurka, J. (Vyzkumny Ustav Energeticky, Bechovice (Czechoslovakia)). 1982. (In Czech). NTIS (US Sales Only), PC A03/MF A01. File Number TI85780003. (CONF-8206259—Vol.3).

From Autos 82 - Automation in engineering meeting; Plzen, Czechoslovakia (15 Jun 1982).

The analysis is described of the reliability of selected accident circuits of the LR-0 experimental reactor using the failure tree method. An analysis was made of the failure to emit accident pulses and of the activity of executive bodies. The probability was calculated of the failure of the operating equipment, the reactor emergency power facility and the facility for measuring the moderator level in dependence on time. An analysis was also made of the reliability of the activity of executive bodies. The failure may take place either as a result of a simultaneous failure of two accident relays or of the simultaneous failure of the moderator discharge and the cluster fall. The computation was carried out on the ODRA 1305 computer using the LOTR program for the computation of the failure tree. The results were to serve as the basis for processing the reactor operating safety report. The results showed that the designed protection system is reliable.

49860 **(Juel—1872) Safety conception of the high temperature reactor with natural heat removal decay in the case of accidents.** Petersen, K. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung; Technische Hochschule Aachen (Germany, F.R.)). Oct 1983. 114p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE84751528.

On September 22, 1970, for the first time an accident simulation experiment with complete failure of the forced core cooling and the nuclear shut-down system was performed in the AVR-reactor: due to a small heat-up of the fuel the nuclear chain-reaction was interrupted and an overheating of the core and structure was prevented due to the natural heat-convection. On the basis of the meanwhile developed computer-methods and accompanying experimental investigations it is now possible to determine exactly the behaviour of the non actively controlled core of the high temperature reactor, and to understand better the course of the AVR-experiments. On the same basis the potential and the limits of the safety conception realized in the AVR with self-stabilization in the case of accident can be determined. Such a small high temperature reactor as for example the HTR-modul of the KWU, which is characterized by a reliable and simple safety-technique with a minimum of expensive active systems, can be realized using a 2-zone-core up to a unit size of nearly 250 MW(th).

49861 **(Juel-Spez—235) Special analyses of the temperature and fission product behaviour of HTR-MODUL plants.** Jahn, W.; Rehm, W.; Verfondern, K. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Sicherheitsforschung). Dec 1983. 83p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE84752163.

The report deals with two special questions for gas-cooled high-temperature reactors for modular design (HTGR-MODUL). The influence of the power of a modular plant during a core heat-up is examined with respect to the inherent limitation of the maximum core temperature below 1600°C. The influence of important safety margins is shown. The expected release of fission products from a fuel sphere is estimated by a parameter study with conservative assumptions. The calculations of fission product release from a core heat-up demonstrate that the cesium release from the coated particles remains low and can even be reduced by more realistic assumptions. In connection with a disturbed heat removal in the primary circuit, the behaviour of the steam generator is analyzed for ATWS-accidents when heating continues in spite of a loss of the water supply. For three characteristic charts of blower run-outs the moment of shut down of the blower is determined in such a way that the temperature limits of the cold gas side are not exceeded.

49862 **(KFK—3470) Proceedings of the 1982 annual colloquium of the Project Nuclear Safety.** (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Nukleare Sicherheit). Jan 1983. 282p. (In German). (CONF-821084—). NTIS (US Sales Only), PC A13/MF A01. File Number DE84751913.

From Nuclear safety project annual colloquium; Karlsruhe, F.R. Germany (26 Oct 1982).

This KFK report contains the full text of eight papers read at the 1982 annual colloquium of PNS. Further information can be obtained from the papers themselves.

49863 (KFK—3470, pp 1-13) **U.S.N.R.C. research on severe accidents and other safety matters.** Mattson, R.J. Jan 1983. NTIS (US Sales Only), PC A13/MF A01. File Number TI84751913. (CONF-821084—).

From Nuclear safety project annual colloquium; Karlsruhe, F.R. Germany (26 Oct 1982).

PRA studies have generally treated core melt accident sequences conservatively in terms of the likelihood of failure and the nature of the radiological release. Unless and until those conservatisms are removed, PRA methods by themselves are insufficient for judging the cost effectiveness of design modification to reduce the risk of severe accidents. The NRC coordinates program management and exchange information regularly with IDCOR and participates in joint programs with EPRI. The NRC has secured the participation of a number of countries in its program of physical research. NRC aims to secure sufficient data and methods to form a sound technical basis for Commission rules on severe accidents.

49864 (KFK—3470, pp 15-82) **Status of the reactor safety research in the Project Nuclear Safety.** Rininsland, H.; Fiege, A.; Gulden, W.; Horsch, F.; Hosemann, J.P. Jan 1983. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number TI84751913. (CONF-821084—).

From Nuclear safety project annual colloquium; Karlsruhe, F.R. Germany (26 Oct 1982).

The dynamic behavior of control rod guide tubes during blowdown is reported. The results of a 7x7-bundle test at the REBEKA facility confirm the existing knowledge from the previous 5x5-bundle tests. First heating up experiments with fuel rod simulators at higher temperatures in steam atmosphere seem to show a temperature escalation up to temperatures above 2200°C may not be expected due to inherent effects. New experimental and calculational results show that the existing risk studies are overestimating the consequences of a core meltdown accident due to conservative assumptions. Even for the adverse case of the release category 2 no early fatalities are to be expected. The testing of first prototypical metal fiber aerosol filters confirms that this new filter material is suitable for accident filters due to its high mechanical, chemical and thermal resistance under extreme conditions.

49865 (KFK—3470, pp 83-106) **Light water reactor hydrogen safety research in the United States.** Berman, M.; Thompson, L. Jan 1983. NTIS (US Sales Only), PC A13/MF A01. File Number TI84751913. (CONF-821084—).

From Nuclear safety project annual colloquium; Karlsruhe, F.R. Germany (26 Oct 1982).

Sandia National Laboratories is conducting a hydrogen research program for the U. S. Nuclear Regulator Commission. The program has two major objectives: assessment of the threat to nuclear power plants (containment structure, safety and control equipment, and the primary system) posed by hydrogen combusion; and assessment of proposed hydrogen control and disposal methods, and development of new concepts. This paper discusses the major program elements, recent research results, and future plans.

49866 (KFK—3470, pp 107-120) **EPRI research on hydrogen combustion and control.** Thompson, L. Jan 1983. NTIS (US Sales Only), PC A13/MF A01. File Number TI84751913. (CONF-821084—).

From Nuclear safety project annual colloquium; Karlsruhe, F.R. Germany (26 Oct 1982).

EPRI conducting a program to study hydrogen combustion behavior in the LWR containment building environments that could follow severe postulated nuclear accidents. Flammability limits, deflagrations, combustion control methods, equipment survivability, hydrogen mixing and distribution in hydrogen, air, steam, and water spray environments have been investigated in several projects. Analytic models and computer codes are also being developed and evaluated for combustion behavior and for hydrogen mixing and distribution processes.

49867 (KFK—3470, pp 159-194) **Chemical interactions between UO_2 and zircaloy-4 from 1000 to 2000°C.** Dienst, W.; Hofmann, P.; Kerwin-Peck, D. Jan 1983. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number TI84751913. (CONF-821084—).

From Nuclear safety project annual colloquium; Karlsruhe, F.R. Germany (26 Oct 1982).

The technical significance of these out-of-pile UO_2/zircaloy reaction experiments is that zircaloy cladding can be oxidized by UO_2 fuel as quickly as by steam, and that UO_2, far below its melting point, can be "liquefied" by molten zircaloy. As a consequence, release of fission gas and volatile fission products is enhanced.

49868 (KFK—3470, pp 195-224) **Investigation in the BETA-test facility into the interaction between a core melt and concrete.** Alsmeyer, H.; Peehs, M.; Perinic, D. Jan 1983. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number TI84751913. (CONF-821084—).

From Nuclear safety project annual colloquium; Karlsruhe, F.R. Germany (26 Oct 1982).

The BETA-test facility is an induction heated melt facility to study the interaction of a core melt with the concrete basement of a LWR. The melt initially generated by a thermite chemical reaction consists of up to 300 kg metallic phase (Fe, Ni, Cr) and 300 kg oxidic phase (mainly Al_2O_3). The measurements concentrate on heat transfer to concrete, melt front velocity and cavity shape in the concrete, long time behavior of concrete under thermal load, solidification processes in the melt, and gas release and composition after chemical reaction with the melt. The aim of the facility is to verify computer codes describing the core concrete interaction in the 4th phase of a core melt down accident.

49869 (KFK—3470, pp 225-260) **Response of HEPA filters to high differential pressures.** Ruedinger, V.; Wilhelm, J. Jan 1983. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number TI84751913. (CONF-821084—).

From Nuclear safety project annual colloquium; Karlsruhe, F.R. Germany (26 Oct 1982).

The results obtained showed that under the favorable conditions of ambient temperature and low relative humidity commercial filters fail between 4 and about 20 kPa. The lower values are obtained with metal frame filters, usually being considered as potential filters for accident conditions. With dust loading the break pressures measured were reduced, by up to 40%. Failure mechanisms were investigated and subsequent first modifications of the filter pack and paper tensile strength led to an increase to 24 kPa of the structural integrity of filters with wooden frames. Since the filter flow resistance characteristic is also safety relevant, this property was investigated too. Comparison with theory revealed that with improved filter design the resistance curves could be shifted towards lower values, thus reducing high differential pressures and the risk of failure.

49870 (KFK—3470, pp 261-278) **Radioecological research on the behavior of actinides in the environment.** Schuettelkopf, H.; Pimpl, M. Jan 1983. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number TI84751913. (CONF-821084—).

From Nuclear safety project annual colloquium; Karlsruhe, F.R. Germany (26 Oct 1982).

The results of the research program on "Investigation of the physical and chemical environmental behavior of radionuclides characterized by a particular biological effectivenes - Pu, Am, Cm" are presented. Analytical procedures for Pu, Am, and Cm were developed. The behavior of Pu in the environment has been studied. Releases, dispersion, deposition, transport in soil, transfer to animals, dilution in a river and sedimentation were measured using Pu from nuclear weapon fallout and Pu release of Karlsruhe Nuclear Fuel Reprocessing Plant. The distribution coefficients and the availability of Pu, Am, and Cm in soil were determined. A greenhouse started its operation during the last months. The transfer factors for Pu, Am, and Cm will be determined for 15 to 20 food plants, and different types of soil.

49871 (KFK—3607-B) **Heat transfer in rod bundles with severe clad deformations.** Ihle, P. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorbauelemente). Apr 1984. 40p. (CONF-830103—46). NTIS (US Sales Only), PC A03/MF A01. File Number DE84752165.

From 2. international topical meeting on nuclear reactor thermal hydraulics (ANS); Santa Barbara, CA, USA (11 Jan 1983).

The content of the paper is focused on heat transfer conditions during the reflood phase of a LOCA in slightly to severely deformed PWR fuel rod bundle geometries. The status of analytical and, especially, of experimental work is described as far as it is possible within this frame. Emphasis is placed on the presentation of the results of "Flooding Experiments with Blocked Arrays" (FEBA), a program performed at the Kernforschungszentrum Karlsruhe in the frame of the Project Nuclear Safety (PNS).

49872 (KFK—3636) **DEMONA - research program for the demonstration of nuclear aerosol behaviour.** Schikarski, W.O. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Lab. fuer Aerosolphysik und Filtertechnik 1; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Nukleare Sicherheit). Dec 1983. 70p. (In German). (EIR—502). NTIS (US Sales Only), PC A04/MF A01. File Number DE84751523.

A research program to demonstrate the behaviour of nuclear aerosols in a large confined volume, as predicted by the aerosol code NAUA, is being carried out in the model containment of Battelle-Frankfurt in cooperation with KfK, EIr and KWU. The latest versions of the aerosol code NAUA and the thermodynamic containment code COCMEL are described together with the planned

tests, the model containment and other facilities used. The objectives of the DEMONA program and the related test matrix are discussed. The extensive instrumentation for aerosol measurements under condensing conditions are described. The time schedule for the DEMONA tests and the related evaluation is given.

49873 **(KFK—3654) SSYST-3. Input description.** Meyder, R. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Nukleare Sicherheit). Dec 1983. 320p. (In German). NTIS (US Sales Only), PC A14/MF A01. File Number DE84751517.

The code system SSYST-3 is designed to analyse the thermal and mechanical behaviour of a fuel rod during a LOCA. The report contains a complete input-list for all modules and several tested inputs for a LOCA analysis.

49874 **(KFK—3663) Annual report 1983 of Hauptabteilung Sicherheit.** Kiefer, H.; Koelzer, W.; Koenig, L.A. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Sicherheit). Apr 1984. 288p. (In German). Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.).

The Central Safety Department is responsible for handling all problems of radiation protection, safety and security of the institutes and departments of the Kernforschungszentrum Karlsruhe GmbH, for waste water activity measurements and environmental monitoring of the whole Center. The research and development work mainly focusing on nuclear safety and radiation protection measures concentrates on the following aspects: studies of the diffusion of nuclear pollutants over distances up to 1,000 km, assessment of the consequences of major reactor accidents under probabilistic aspects, studies of the physical and chemical behavior of biologically particularly active radionuclides, improvement in radiation protection measurement and personnel dosimetry.

49875 **(KFK—3670) Proceedings of the 1983 annual colloquium of the Project Nuclear Safety.** (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Nukleare Sicherheit). Feb 1984. 259p. (In German). (CONF-8311169—). NTIS (US Sales Only), PC A12/MF A01. File Number DE84751925.

From Annual colloquium of the nuclear safety project; Karlsruhe, F.R. Germany (21 Nov 1983).

The full text of the eight papers read at the 1983 Annual Colloquium of the Nuclear Safety Project in the Karlsruhe Nuclear Research Centre are presented. For further information please see the subject description of the individual papers.

49876 (KFK—3670, pp 2-9) **Engineer-constructor's view of nuclear power plant safety.** Landis, J.W.; Jacobs, S.B. Feb 1984. NTIS (US Sales Only), PC A12/MF A01. File Number TI84751925. (CONF-8311169—).

From Annual colloquium of the nuclear safety project; Karlsruhe, F.R. Germany (21 Nov 1983).

At SWEC we have been involved in the development of safety features of nuclear power plants ever since we served as the engineer-constructur for the first commerical nuclear power station at Shippingport, Pennsylvania, in the 1950s. Our personnel have pioneered a number of safety innovations and improvements. Among these innovations is the subatmospheric containment for pressurized water reactor (PWR) power plants. This type of containment is designed so that leakage will terminate within 1 to 2 hours of the worst postulated loss of coolant accident. Other notable contributions include first use of reinforced-concrete atmospheric containments for PWR power plants and of reinforced-concrete, vapor-suppression containments for boiling water reactor (BWR) power plants. Both concepts meet rigorous U.S. safety requirements. SWEC has performed a substantial amount of work on developing standardized plant designs and has developed standardized engineering and construction techniques and procedures. Standardization concepts are being developed in Canada, France, USSR, and Germany, as well as in the United States. The West German convoy concept, which involves developing a number of standardized plants in a common effort, has been quite successful. We believe standardization contributes to safety in a number of ways. Use of standardized designs, procedures, techniques, equipment, and methods increases efficiency and results in higher quality. Standardization also reduces the design variations with which plant operators, emergency teams, and regulatory personnel must be familiar, thus increasing operator capability, and permits specialized talents to be focused on important safety considerations.

49877 (KFK—3670, pp 11-30) **Experience with regard to safety of installations at the Biblis nuclear power plant.** Meyer, F. Feb 1984. (In German). NTIS (US Sales Only), PC A12/MF A01. File Number TI84751925. (CONF-8311169—).

From Annual colloquium of the nuclear safety project; Karlsruhe, F.R. Germany (21 Nov 1983).

The report does not deal with experience with nuclear safety in its strict sense, because no incident of this kind has occured. The term plant safety has been extended to the meaning of reliability of operations or, in other words, to plant availability. Therefore, the report rather explains by means of a few examples and diagrams how failures which can lead to serious disturbances with transients, turbine- or reactor trips have early been recognized, and which suitable actions were taken to minimize the numer of failures, transients and shutdowns. This is valid for technical failures as well as for human behaviour (c. 50% each). These measures resulted in an effective reduction of the number of transients and reactor scrams, and consequently also of the probability of incidents which could endanger plant safety.

49878 (KFK—3670, pp 31-109) **Status of the reactor safety research in the Project Nuclear Safety.** Bork, G.; Fiege, A.; Gulden, W.; Hosemann, J.P.; Rininsland, H. Feb 1984. (In German). NTIS (US Sales Only), PC A12/MF A01. File Number TI84751925. (CONF-8311169—).

From Annual colloquium of the nuclear safety project; Karlsruhe, F.R. Germany (21 Nov 1983).

The investigations on mechanical behavior of structures are more and more concentrated on the behavior of the containment of a PWR during and after a core meltdown accident in order to describe the probable modes of failure. First experimental and analytical results are reported. The analytical work on thermal shock is accompanied by experiments on plates with well defined, natural cracks. First results are in good agreement with the calculated crack growth. Basic investigations on simultaneous inner and outer oxidation of Zry-tubes at elevated temperatures were performed. The construction of four big experimental facilities, CORA, BETA, DEMONA and BORA is nearly completed. In 1984 the experiments can be started. A so-called "iodine model" describing the physical and chemical behavior of iodine and cesium has been developed and internationally discussed. Radioecoiogical investigations are focussed on the transfer of nuclides soil-plant and on the influence of microbiological systems. In the frame of the safety analysis of a big reprocessing plant the modelling of the off-gas cleanup system is available as a basis for accident evaluation as well as for operation, maintenance and repair. The international cooperation was intensified and concentrates mainly on investigations of hypothetical accidents and a realistic assessment of their consequences.

49879 (KFK—3670, pp 111-139) **Assessment of integrity for the pressure vessel internals of PWRs under blowdown loadings.** Geiss, M.; Benner, J.; Ludwig, A. Feb 1984. (In German). NTIS (US Sales Only), PC A12/MF A01. File Number TI84751925. (CONF-8311169—).

From Annual colloquium of the nuclear safety project; Karlsruhe, F.R. Germany (21 Nov 1983).

In safety analysis of pressurized water reactors the loss-of-coolant accident plays a central role. Thereby a sudden break of a cold primary coolant pipe close to the reactor pressure vessel is postulated. The sudden pressure release of the primary system (blowdown) causes high dynamic loading on the pressure vessel internals. The resulting deformations must not impair shut down of the reactor and decay heat removal in an inadmissible way. For this assessment a blowdown analysis for a 1300 MW pressurized water reactor is carried out. These investigations are completed with a detailed stress analysis for the highly loaded core barrel clamping.

The results show that the reactor pressure vessel internals are able to withstand blowdown loading. Even in case of a sudden and complete break of the primary coolant pipe the loading has to be twice as high to endanger the structural integrity.

49880 (KFK—3670, pp 171-201) **Investigations on temperature escalation under severe fuel damage conditions.** Hagen, S.; Peck, S.P. Feb 1984. (In German). NTIS (US Sales Only), PC A12/MF A01. File Number TI84751925. (CONF-8311169—).

From Annual colloquium of the nuclear safety project; Karlsruhe, F.R. Germany (21 Nov 1983).

In every single-rod and in the rod-bundle tests on temperature escalation, the temperatures observed remained below a maximum of 2250°C. This limitation is due to processes during heatup. The experiments have shown that formation of a protective oxide layer and the runoff of molten zircaloy are a limiting process for temperature escalation. At higher temperatures, the transport mechanism in the gas phase is assumed to play a major part. The posttest examination of the bundles revealed that the runoff zircaloy-UO_2 melt agglomerates to form a lumpy mass at the lower end of the rod bundle. Powdery rubble, fuel that fractured during cooldown, had been found on top of the blockages. Metallographic, EMP, and SEM examinations provided information on the dissolution of UO_2 by liquid zircaloy and on the phases occurring during cooldown. The results are in good agreement with those obtained in single-effect experiments made by the Materials Research Institute of Karlsruhe Nuclear Research Centre. The ZrO_2 in the melt, formed during initial heatup, is subsequently dissolved by the melt through extraction of oxygen. When the melt gets into contact with steam, the melt itself will oxidize to form a (U, Zr)O_2 mixed oxide.

49881 (KFK—3670, pp 203-231) **Release of radioactivity and formation of aerosols during LWR core meltdown.** Albrecht, H. Feb 1984. (In German). NTIS (US Sales Only), PC A12/MF A01. File Number TI84751925. (CONF-8311169—).

From Annual colloquium of the nuclear safety project; Karlsruhe, F.R. Germany (21 Nov 1983).

At the SASCHA facility, melting experiments were carried out to determine fractional release rate coefficients for all relevant elements in the core at two temperatures, 2200 and 2400°C. By use of a simplified time dependence of the average core temperature, integral amounts of the released nuclide activities and of the aerosol masses were calculated. The results are applicable to the reference reactor Biblis B of the German Risk Study for which a large pipe break in the primary system and a medium burnup of 21 GWd/t was assumed. The main findings are: 1. The integral activity release from the core is 16 +- 2% of the radioactive inventory two hours after the reactor shutdown. The integral aerosol mass emerging from the primary system is about 1560 kg with an uncertainty factor of two. 2. About 99% of the released activity results form the nuclides of only 6 elements: Kr, Xe, I, Cs, Te, and Sb. The highest contribution to the aerosol mass is due to the element Ag, the main component of the absorber material. 3. The contributions of Te, Ba (Sr), and Ag depend strongly on the degree of the Zircaloy oxidation and on the time/temperature function assumed for the core. A potential overestimation of the release of Te and Ag prior to the RPV failure will be compensated by the fact that these elements are also strongly released during the melt/concrete interaction.

49882 (KFK—3671) **KANDY - a numerical model to describe phenomena, which - in a heated and voided fuel element of an LMFBR - may occur.** Thurnay, K. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Schneller Brueter). Feb 1984. 110p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE84751922.

Kandy is a model developed to describe the essential destruction phenomena of the fuel elements of an LMFBR. The fuel element is assumed to be a voided one, in which the heat generation is still going on. The main process to be modeled is the melting/bursting/evaporating of parts of the fuel pins and the subsequent dislocation of these materials in the coolant channel. The work presented summarizes the assumptions constituting the model, develops the corresponding equations of motion and describes the procedure, turning these into a system of difference-equations ready for coding. As a final part results of a testcase calculation with the Kandy-code are presented and interpreted.

49883 (KFK—3707) **Fluid-structure-interaction of the pressurized water reactor core internals during blowdown - numerical simulation with a homogenization model.** Benner, J. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Nukleare Sicherheit; Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Maschinenbau). Mar 1984. 136p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE84751923.

A method for the numerical simulation of the Pressurized Water Reactor (PWR) core internal's behaviour during a blowdown accident is described, by which the motion of the reactor core and the interaction of the fuel elements with the core barrel and the coolant medium is calculated. Furthermore, some simple models for the support columns, lower and upper core support and the grid plate are provided. All these models have been implemented into the code Flux-4. For the solution of the very complex, coupled equations of motions for fluid and fuel rods an efficient numerical solution technique has been developed. With the new code-version Flux-5 the PWR-blowdown is parametically investigated. The calculated core barrel loadings are compared with Flux-4 results, simulating the core's inertia by a mass ring of HDR type.

49884 **(KFK—3719) Scientific work of Leonardo Caldarola.** (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung). Mar 1984. 75p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE84752155.

The present KfK report, dedicated to the deceased Leonardo Caldorala, gives the full text of three important papers of L. Caldarola: 1) The balanced oscillator experiment; 2) Fuel-coolant interaction in fast reactors and 3) Coherent systems with multistate components.

49885 **(KTH-NEL—33(Vol.1,2)) Experimental investigation of post dryout heat transfer.** Becker, K.M.; Ling, C.H.; Hedberg, S.; Strand, G. (Royal Inst. of Tech., Stockholm (Sweden). Dept. of Reactor Technology). May 1983. 377p. NTIS (US Sales Only), PC A17/MF A01. File Number DE84703151.

The present report contains the results of post-dryout measurements which have been carried out in the Department of Nuclear Reactor Engineering at the Royal Institute of Technology. More than 15000 heat transfer coefficients were obtained for electrically heated round tubes in the post-dryout regime, covering the following ranges of parameters: Heated length L=7000 mm, Inner diameter d(sub)i=14.90, 10.00 and 24.69 mm, Inlet subcooling Δt(sub)i=10degreeC, Pressure p=30-205 bar, Mass velocity G=500-3000 kg/m²s, Heat flux g/A=9-125 W/cm², PDO steam quality x(sub)PDO=0.03-1.66. A brief description of the experimental equipment is given as well as a table containing the experimental results. The data have been stored on a tape which is available at the department of Nuclear Reactor Engineering at the Royal Institute of Technology.

49886 **(LA-UR—84-2953) Nuclear Plant Analyzer: an interactive TRAC/RELAP Power-Plant Simulation Program.** Steinke, R.; Booker, C.; Giguere, P.; Liles, D.; Mahaffy, J.; Turner, M.; Wiley, R. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 11p. (CONF-841115—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002036.

From International conference on power plant simulation; Mexico City, Mexico (19 Nov 1984).

The Nuclear Plant Analyzer (NPA) is a computer-software interface for executing the TRAC or RELAP5 power-plant systems codes. The NPA is designed to use advanced supercomputers, long-distance data communications, and a remote workstation terminal with interactive computer graphics to analyze power-plant

thermal-hydraulic behavior. The NPA interface simplifies the running of these codes through automated procedures and dialog interaction. User understanding of simulated-plant behavior is enhanced through graphics displays of calculational results. These results are displayed concurrently with the calculation. The user has the capability to override the plant's modeled control system with hardware adjustment commands. This gives the NPA the utility of a simulator, and at the same time, the accuracy of an advanced, best-estimate, power-plant systems code for plant operation and safety analysis.

49887 **(NUREG—0420-Suppl.7) Safety evaluation report related to the operation of Shoreham Nuclear Power Station, Unit No. 1 (Docket No. 50-322). Supplement No. 7.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Sep 1984. 159p. NTIS, PC A08/MF A01 - GPO* $5.50. File Number TI85900062.

Supplement 7 (SSER 7) to the Safety Evaluation Report on Long Island Lighting Company's application for a license to operate the Shoreham Nuclear Power Station, Unit 1, located in Suffolk County, New York, has been prepared by the Office of Nuclear Reactor Regulation of the US Nuclear Regulatory Commission. This supplement addresses several items that have been reviewed by the staff since the previous supplement was issued.

49888 **(NUREG—1083) Safety Evaluation Report related to the renewal of the operating license for the Westinghouse research reactor at Zion, Illinois (Docket No. 50-87).** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Sep 1984. 74p. NTIS, PC A04/MF A01 - GPO* $4.50. File Number TI85900260.

This Safety Evaluation Report, for the application filed by the Westinghouse Electric Company, for renewal of operating license number R-119 to continue to operate the research reactor, has been prepared by the Office of Nuclear Reactor Regulation of the US Nuclear Regulatory Commission. The facility is operated by Westinghouse and is located in Zion, Illinois. The staff concludes that the reactor facility can continue to be operated by Westinghouse without endangering the health and safety of the public.

49889 **(NUREG/CR—2576) BWR Full Integral Simulation Test (FIST) program: facility description report.** Stephens, A.G. (ed.). (General Electric Co., San Jose, CA (USA). Nuclear Fuel and Special Projects Div.). Sep 1984. 265p. (EPRI-NP—2314; GEAP—22054). NTIS, PC A12/MF A01 - GPO* $7.50. File Number TI85900036.

A new boiling water reactor safety test facility (FIST, Full Integral Simulation Test) is described. It will be used to investigate small breaks and operational transients and to tie results from such tests to earlier large-break test results determined in the TLTA. The new facility's full height and prototypical components constitute a major scaling improvement over earlier test facilities. A heated feedwater system, permitting steady-state operation, and a large increase in the number of measurements are other significant improvements. The program background is outlined and program objectives defined. The design basis is presented together with a detailed, complete description of the facility and measurements to be made. An extensive component scaling analysis and prediction of performance are presented.

49890 **(NUREG/CR—3663-Vol.2) Probability of pipe failure in the reactor coolant loops of Combustion Engineering PWR plants. Volume 2. Pipe failure induced by crack growth.** Lo, T.Y.; Mensing, R.W.; Woo, H.H.; Holman, G.S. (Lawrence Livermore National Lab., CA (USA)). Sep 1984. Contract W-7405-ENG-48. 88p. (UCRL—53500-Vol.2). NTIS, PC A05/MF A01 - GPO $4.50. File Number TI84013378.

A study was conducted to determine if the probability of occurrence of a double-ended guillotine break (DEGB) in the primary coolant piping warrants the current design requirements that safeguard against the effect of DEGB. This report describes the results of an assessment of reactor coolant loop piping systems designed by Combustion Engineering, Inc. A probabilistic fracture mechanics approach was used to estimate the crack growth and to assess the crack stability in the piping throughout the lifetime of the plant. The results of the assessment indicate that the probability of occurrence of DEGB due to crack growth and instability is extremely small, which supports the argument that the postulation of DEGB in design should be eliminated and replaced with more reasonable criteria.

49891 **(NUREG/CR—3665-Exec.Summ.) Optimization of public and occupational radiation protection at nuclear power plants. Executive summary.** Cohen, J.J. (Science Applications, Inc., Pleasanton, CA (USA)). Sep 1984. 10p. (SAIC—84/1317-Exec.Summ.). NTIS, PC A02/MF A01 - GPO* $3.00. File Number TI85900068.

An area of growing concern in recent years has been the apparent increase in levels of collective radiation dose to workers at nuclear power plants in the USA. US Nuclear Regulatory Commission (NRC) decisions and rulings related to in-service inspection, retrofits, and plant upgrades have been primarily intended to reduce the risk of public radiation exposure resulting from either routine release of radioactivity or potential accident situations. However, implementation of the required control measures and procedures can often result in increased levels of occupational radiation exposure. Recognizing the need to incorporate occupational dose into probabilistic risk assessments (PRA), value-impact, and cost-benefit analyses, the NRC has sponsored this study with the objective of developing an appropriate methodology to factor potential worker exposures into safety assessments. This report on the study is presented in three volumes. The following are subtitles for Volumes 1 to 3: Volume 1, A Review of Occupational Dose Assessment Considerations in Current Probabilistic Risk Assessments and Cost-Benefit Analyses, Volume 2, Considerations in Factoring Occupational Dose into Value-Impact and Cost-Benefit Analyses, and Volume 3, A Calculation Method.

49892 **(NUREG/CR—3765) MINET simulation of a helical coil sodium/water steam generator, including structural effects.** Van Tuyle, G.J. (Brookhaven National Lab., Upton, NY (USA)). Apr 1984. Contract AC02-76CH00016. 29p. (BNL-NUREG—51766). NTIS, PC A03/MF A01 - GPO. File Number TI84016795.

A test transient performed at a helical coil sodium-to-water steam generator test facility was simulated using the MINET code. It was determined that correct calculation of the sodium outlet temperature requires representation of heat capacitance of the structure.

49893 **(NUREG/CR—3813) MINET validation study using steam generator transient data.** Van Tuyle, G.J. (Brookhaven National Lab., Upton, NY (USA)). May 1984. Contract AC02-76CH00016. 39p. (BNL-NUREG—51775). NTIS, PC A03/MF A01 - GPO. File Number TI84016805.

Three steam generator transient test cases, that were simulated using the MINET computer code, are described, with computed results compared against experimental data. The MINET calculations closely agreed with the experiment for both the once-through and the U-tube steam generator test cases. The effort is part of an ongoing effort to validate the MINET computer code for thermal-hydraulic plant systems transient analysis, and strongly supports the validity of the MINET models.

49894 **(NUREG/CR—3988) MARCH 2 (Meltdown Accident Response Characteristics) code description and user's manual.** Wooton, R.O.; Cybulskis, P.; Quayle, S.F. (Battelle Columbus Labs., OH (USA)). Sep 1984. 419p. (BMI—2115). NTIS, PC A18/MF A01 - GPO* $8.50. File Number TI85900008.

MARCH 2 describes the response of water-cooled reactor systems to accidents which, because of failures in engineered safety features, lead to core meltdown. The code performs the calculations from the time of accident initiation through the stages of coolant blowdown and boiloff, core heat up and meltdown, pressure vessel bottom head melting and failure, and debris-water and debris-concrete interactions in the reactor cavity. Both the primary system and the containment building are modeled. Mass and energy additions to the containment building are evaluated and the pressure-temperature response of the containment with or without engi-

neered safety features is calculated. A maximum of eight containment sub-volumes may be modeled. Engineered safety features modeled include emergency core cooling systems, containment sprays, building coolers and fans, suppression pool and ice condenser containments, and emergency core cooling and spray heat exchangers. Effects of metal-water reactions, combustion of hydrogen and carbon monoxide, heat losses to containment structures, and redistribution of the decay heat due to loss of volatile fission products from the core are considered.

49895 **(OEFZS—4272) Physical models and numerical methods of the reactor dynamic computer program RETRAN.** Kamelander, G.; Woloch, F.; Sdouz, G.; Koinig, H. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). Mar 1984. 51p. (In German). (RS—235/84). NTIS (US Sales Only), PC A04/MF A01. File Number DE84703148.

This report describes the physical models and the numerical methods of the reactor dynamic code RETRAN simulating reactivity transients in Light-Water-Reactors. The neutron-physical part of RETRAN bases on the two-group-diffusion equations which are solved by discretization similar to the TWIGL-method. An exponential transformation is applied and the inner iterations are accelerated by a coarse-mesh-rebalancing procedure. The thermo-hydraulic model approximates the equation of state by a built-in steam-water-table and disposes of options for the calculation of heat-conduction coefficients and heat transfer coefficients.

49896 **(OEFZS—4276) Austrian contributions to fuel rod failure models shown at the International Standard Problem ISP-14.** Sdouz, G. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). Apr 1984. 55p. (In German). (RS—238/84). NTIS (US Sales Only), PC A04/MF A01. File Number DE84703154.

The computer code BALON-2A was improved to perform the International Standard Problem ISP-14. The main extensions are the implementation of input-options and the development of a model to predict the pressure in the fuel rod gap. With these improvements and some calculations for input values satisfying results have been obtained. This is remarkable because loss of coolant accident analyses are performed usually with larger computer codes.

49897 **(PNL—4198) Characterization of emergency preparedness at DOE contractor facilities.** Gillings, J.C.; Murphy, B.L.; Corbit, C.D.; MacLellan, J.A.; Essig, T.H.; Higby, D.P.; Hooker, C.D.; Laughlin, G.J.; Stoetzel, G.A.; Swinth, K.L. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1984. Contract AC06-76RL01830. 255p. NTIS, PC A12/MF A01; 1; GPO Dep. File Number DE85001033.

A study of emergency preparedness capabilities at DOE facilities was initiated following the incident at the Three Mile Island (TMI) Nuclear Power Station. It was designed to parallel but expand on a study on emergency preparedness instrumentation that was conducted in 1970 by Pacific Northwest Laboratory. The 1970 survey findings led to the publication of four reports on performance criteria for radiological emergency instrumentation. Three of these reports - BNWL-1635 (Selby et al. 1972), BNWL-1742 (Anderson et al. 1974) and BNWL-1857 (Andersen et al. 1976) - addressed the criteria for emergency instrumentation at reactors, mixed oxide fuel fabrication plants, and fuel reprocessing plants, respectively. The fourth report, BNWL-1991 (Bramson et al. 1976), addressed evaluation testing and calibration methodology for these instruments. This report is presented in three parts. Part One is a review of the BNWL documents to determine whether they are applicable to state-of-the-art instrument capabilities. The Appendix to Part One provides a comparison between the instrument performance criteria established in BNWL-1991 to applicable American National Standards Institute (ANSI) standards for portable survey and contamination meters, installed radiation and area monitors, effluent monitors, calibration techniques, criticality detection systems, alarm systems, and direct reading dosimeters. Part Two compares the 1970 survey results with the 1980 survey results to identify trends in emergency preparedness. Part Three is a discussion of the results of the 1980 emergency preparedness survey and the supporting data for each of the 15 modules. 8 references. (ACR)

49898 **(PNL-SA—12426) Pipe to pipe impact.** Bampton, M.C.C.; Alzheimer, J.M.; Friley, J.R.; Simonen, F.A. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1984. Contract AC06-76RL01830. 15p. (CONF-840763—5). NTIS (US Sales Only), PC A02/MF A01; GPO Dep. File Number DE85000368.

From MITI-USNRC seismic information exchange meeting; Palo Alto, CA, USA (18 Jul 1984).

Existing licensing criteria express what damage shall be assumed for various pipe sizes as a consequence of a postulated break in a high energy system. The criteria are contained in Section 3.6.2 of the Standard Review Plan, and the purpose of the program described within this paper is to evaluate the criteria by means of a combined experimental and analytical approach. A specialized impact machine was designed and fabricated for the test program. Specimens were impacted while at PWR conditions. Impact energy was used as a controlled variable in order to establish its relationship to damage. An analysis model has been developed for the purpose of extending the test results to other impact conditions. The outputs expected from the program could be two-fold: changes to the criteria, after appropriate value/impact evaluations, and an analytic capability for rapidly evaluating the potential for pipe whip damage after a postulated break.

49899 **(SAND—84-0522C-Rev.) Coolability of UO_2 debris beds in pressurized water pools: DCC-1 and DCC-2 experiment results. Revision.** Reed, A.W.; Bergeron, E.D.; Boldt, K.R.; Schmidt, T.R. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 9p. (CONF-840914—16-Rev.). NTIS, PC A02/MF A01; GPO Dep. File Number DE85001447.

From International meeting on thermal nuclear reactor safety; Karlsruhe, F.R. Germany (10 Sep 1984).

DCC-1 and DCC-2 have provided the first in-pile data for water-urania dryout heat flux and quench behavior. DCC-1, designed to test the laminar flow region of dryout, has displayed unexpected results. While the dryout fluxes at one atmosphere are approximately those predicted by many of the models, the pressure dependence of the dryout data is predicted by none of the models. The quench behavior of DCC-1 displays none of the fingering observed in out-of-pile experiments. The quench times extend for hours. The DCC-2 dryout data conform in magnitude and pressure dependence with several of the models. In addition to global dryouts, in which the dry zone extends across the width of the bed, local dryouts were observed. These are zones of lower than average permeability which dry out and achieve stable temperatures without eliminating coolant flow to the bottom of the bed. The quench times in DCC-2 are only a few minutes long. Fingering, modified by the radially varying temperature of the dry particles, was observed.

49900 **(SRD-R—281) Causes of larger degraded core frequencies in earlier safety studies compared with Sizewell 'B'.** Debenham, A.A.; Bonell, P.G. (UKAEA Safety and Reliability Directorate, Culcheth). Jan 1984. 22p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703157.

The degraded core frequency given by the Sizewell 'B' safety study due to internal initiators is lower than that given by earlier safety studies. The results of three safety studies are compared with those for Sizewell and the design features of the Sizewell plant, which giving significant benefits in minimising degraded core frequency are explained. The main contributions to degraded core frequency from the various internal initiating events and subsequent safety system failures in the three studies are compared with the corresponding contributions for Sizewell.

49901 **(UCID—20211) Categorization of PWR accident sequences and guidelines for fault trees: seismic initiators.** Kimura, C.Y. (Lawrence Livermore National Lab., CA (USA)). Sep 1984. Contract W-7405-ENG-48. 70p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85001587.

This study developed a set of dominant accident sequences that could be applied generically to domestic commercial PWRs as a standardized basis for a probabilistic seismic risk assessment. This was accomplished by ranking the Zion 1 accident sequences. The

pertinent PWR safety systems were compared on a plant-by-plant basis to determine the applicability of the dominant accident sequences of Zion 1 to other PWR plants. The functional event trees were developed to describe the system functions that must work or not work in order for a certain accident sequence to happen, one for pipe breaks and one for transients.

49902 **(UCID—20212-Rev.1) SSI sensitivity studies and model improvements for the US NRC Seismic Safety Margins Research Program. Rev. 1.** Johnson, J.J.; Maslenikov, O.R.; Benda, B.J. (Structural Mechanics Associates, San Ramon, CA (USA)). Oct 1984. Contract W-7405-ENG-48. 154p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE85002088.

The Seismic Safety Margins Research Program (SSMRP) is a US NRC-funded program conducted by Lawrence Livermore National Laboratory. Its goal is to develop a complete fully coupled analysis procedure for estimating the risk of an earthquake-induced radioactive release from a commercial nuclear power plant. In Phase II of the SSMRP, the methodology was applied to the Zion nuclear power plant. Three topics in the SSI analysis of Zion were investigated and reported here - flexible foundation modeling, structure-to-structure interaction, and basemat uplift. The results of these investigations were incorporated in the SSMRP seismic risk analysis. 14 references, 51 figures, 13 tables.

25 ENERGY STORAGE

REFER ALSO TO CITATION(S) 25000049959

2501 Magnetic

49903 **Tests of the 30 MJ superconducting magnetic energy storage unit.** Boenig, H.J.; Dean, J.W.; Rogers, J.D.; Schermer, R.I. (Los Alamos National Laboratory, NM (U.S.A.)); Hauer, J.F. (Bonneville Power Administration, Portland, OR (U.S.A.)). *Journal de Physique (Paris), Colloque;* 45: 575-580(Jan 1984). (CONF-830971—).

From 8. international conference on magnet technology and exhibition; Grenoble, France (5 Sep 1983).

A 30 MJ (8.4 kWh) superconducting magnetic energy storage (SMES) unit with a 10 MW converter was installed during the later months of 1982 at the Bonneville Power Administration (BPA) Tacoma substation in Tacoma, Washington. The unit, which is capable of absorbing and releasing up to 10 MJ of energy at a frequency of 0.35 Hz, was designed to damp the dominant power swing mode of the Pacific AC Intertie. Extensive tests were performed with the unit during the first half of 1983. This paper will review the major components of the storage unit and describe the startup and steady state operating experience with the coil, dewar, refrigerator and converter. The unit has absorbed power up to a level of 11.8 MW. Real power was modulated following a sinusoidal power demand with frequencies from 0.1 to 1.2 Hz and a power level up to +-8.3 MW. The unit has performed in accordance with design expectations and no major problems have developed.

2502 Compressed Gas

49904 **(PNL-SA—11884) Outcome of compressed air energy storage at Pittsfield, Illinois.** Allen, R.D.; Doherty, T.J. (Pacific Northwest Lab., Richland, WA (USA)). Mar 1984. Contract AC06-76RL01830. 22p. (CONF-840804—51-Draft). NTIS, PC A02/MF A01; GPO Dep. File Number DE85000395.

From Intersociety energy conversion engineering conference; San Francisco, CA, USA (19 Aug 1984).

A field experiment to examine feasibility of full-scale compressed air energy storage (CAES) within aquifer reservoirs was sponsored consecutively by the US Department of Energy and the Electric Power Research Institute. Parameters simulated storage and recovery operations within a single well. Testing demonstrated injection, storage, and cycling. A thin lenticular air bubble was injected into a dome-shaped structure involving the permeable, water-saturated St. Peter sandstone overlain by the impervious Joachim dolomite. Water coning during air withdrawal was not a significant problem. Cohesion of the sandface and near-wellbore region was sufficient to prevent serious erosion. No important mineral alterations were detected within the small amount of withdrawn solid particulate material. Well completion technique is extremely important to assure continuing high permeability of the sandface. Relationships among pressure, mass flow rate, temperature, and time are presented for injection and withdrawal experiments. Mass flow rate can be limited by the permeability of the sandface and near reservoir. Air stored for several months became depleted in oxygen, probably because of oxidation reactions with sulfides or suboxides in the reservoir and/or caprock. Heat was not injected into the aquifer at thermodynamically useful levels. Well bore heat loss by conduction and radiation were dominant.

2506 Thermal

REFER ALSO TO CITATION(S) 25060049718, 49969

49905 **(CONF-840401—1) Composite latent/sensible energy storage media for high-temperature industrial applications.** Olszewski, M. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001104.

From European congress on economics and management of energy in industry; Algarve, Portugal (2 Apr 1984).

An advanced thermal energy storage media concept is being developed for industrial process and reject heat applications. This composite medium consists of a phase-change carbonate salt, supported and immobilized within a submicron-sized capillary structure of a particulate ceramic matrix of porous sintered ceramic. Immobilization of the molten salt within the ceramic structure permits operation of the composite pellets, bricks or other shapes in direct contact with compatible fluids. Energy storage occurs in both sensible and latent forms with the composite providing higher energy storage densities than standard sensible heat storage systems. This paper describes the composite latent/sensible media concept and its potential advantage over state-ofthe-art systems. Current development activities concerning media stability and fabrication are described. Economic viability of the concept, especially in comparison to extant sensible heat storage systems, is also presented.

49906 **(CONF-8403146—3) Assessment of nonlatent heat storage technologies for industrial applications.** Melikian, G.; McChesney, H.R. (United Technologies Research Center, East Hartford, CT (USA)). 1984. Contract AC05-84OR21400. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001100.

From IEA workshop on latent heat stores; Stuttgart, F.R. Germany (5 Mar 1984).

An analytical assessment has been carried out to determine the role of thermal energy storage (TES) in the recovery and utilization of industrial waste heat. A major feature of this assessment was the characterization of energy recovery and TES technologies. Specific TES applications were selected using detailed process data obtained from on-site plant visits to selected industries. Proposed waste heat recovery and utilization systems were designed and optimized using a computer model and an equipment data base to obtain the maximum rate of return (ROR) on investment and displacement of fossil fuel for each application. The economic benefits, net energy savings and applications have an after-tax ROR >20%. Nine of these systems utilize TES.

49907 **(CONF-8403146—4) Advanced latent heat storage media for high-temperature industrial applications.** Olszewski, M. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000907.

From IEA workshop on latent heat stores; Stuttgart, F.R. Germany (5 Mar 1984).

Several advanced thermal energy storage (TES) media are being developed for high-temperature industrial applications as part of the Oak Ridge National Laboratory (ORNL) TES Program. One of these concepts involves a composite medium consisting of a phase-change carbonate salt supported and immobilized within a

submicron-sized capillary structure of a particulate ceramic matrix or porous sintered ceramic. Immobilization of the molten salt within the ceramic structure permits operation of the composite pellets, bricks, or other shapes in direct contact with compatible fluids. Energy storage occurs in both sensible and latent forms with the composite providing higher energy storage densities than standard sensible heat storage systems. The second concept centers on the development of a self-encapsulating metallic eutectic. This work focuses on metallic eutectics containing silicon. Starting with a silicon-rich mixture, it is feasible to develop a self-encapsulating pellet by cooling the liquid drops at a controlled rate. A solid of nearly pure silicon will form on the exterior of the pellet leaving a eutectic, phase-change media in the interior. This paper describes the concepts and provides information concerning current development activities.

49908 **(LBL-PUB—3044) Steady flow model user's guide.** Doughty, C.; Hellstrom, G.; Tsang, C.F.; Claesson, J. (Lawrence Berkeley Lab., CA (USA); Lund Inst. of Tech. (Sweden). Dept. of Mathematical Physics). Jul 1984. Contract AC03-76SF00098. 47p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85002001.

Sophisticated numerical models that solve the coupled mass and energy transport equations for nonisothermal fluid flow in a porous medium have been successfully used to match analytical results as well as field data for aquifer thermal energy storage (ATES) systems. Generally these models are expensive and time-consuming to use. Typically an ATES study is concerned primarily with energy balances and heat flows. Often the fluid flow field is simple and reaches steady-state rapidly. As an alternative for this sort of ATES problem the Steady Flow Model (SFM), a simplified but fast numerical model, has been developed. Rather than solving the mass transport equation to obtain a fluid flow field that varies with time, a steady purely radial flow field is prescribed in the aquifer, and incorporated into the heat transport equation which is then solved numerically. While the radial flow assumption limits the range of ATES systems that can be studied using the SFM, it greatly simplifies use of this code. The preparation of input is quite simple compared to that for a sophisticated coupled mass and energy model, and the cost of running the SFM is far cheaper as well. Furthermore, the simple flow field allows use of a special calculational mesh that eliminates the numerical dispersion usually associated with the numerical solution of convection problems. The present report defines the problem considered, briefly outlines the algorithm used to solve it, then describes the input and output for the SFM.

49909 **(PB—84-212497) Study of storage capacity in a captive aquifer used as geothermal reservoir. Final report and summary report.** Depois, J.; Clamens, H. (Commission of the European Communities, Luxembourg). 1983. 291p. (In French). (EUR—8539-FR). NTIS, PC E12/MF E12.

Studies have begun in order to establish the feasibility of underground heat storage (180-200C) in a captive aquifer encountered at depths greater than 200 meters. To demonstrate the feasibility of this type of heat storage, a site was selected at Thiverval-Grignon, a town 30 km West of Paris. An exploratory well was drilled in 1980 on the site of a household waste incineration plant and fully equipped at a depth of 508 m in the Wealdien aquifer, which has been selected for the demonstration phase. This well has provided important data concerning the hydrogeological and geochemical behavior of the aquifer. By introducing these data into mathematical models, the feasibility of the selected underground heat storage has been confirmed. (Copyright (c) CECA-CEE-CEEA, Bruxelles-Luxembourg 1983.)

49910 **(PNL-SA—12191) Field testing of aquifer thermal energy storage.** Kannberg, L.D.; Allen, R.D. (Pacific Northwest Lab., Richland, WA (USA)). Mar 1984. Contract AC06-76RL01830. 9p. (CONF-840804—52). NTIS, PC A02/MF A01; GPO Dep. File Number DE85000399.

From Intersociety energy conversion engineering conference; San Francisco, CA, USA (19 Aug 1984).

Results of recent field and laboratory studies of aquifer thermal energy storage (ATES) indicate both the problems and promise of the concept. Geohydrothermal modeling and field testing have demonstrated the ability to recover substantial quantities of aquifer-stored energy. However, the local hydrologic conditions play an important role in determining the recovery temperature and storage efficiency. Geochemistry is also an important factor, particularly for higher temperature ATES systems. Whereas available hydrothermal models are adequate to estimate the thermal performance of ATES systems, geochemical ATES models are still in their infancy.

2509 Batteries

49911 **(AD-A—142004/1) Rapid electrolyte exchange procedures for 22 AH Nickel-Cadmium Celgard cells.** Verville, G.; Powell, P. (Defence Research Establishment, Ottawa, Ontario (Canada)). Apr 1984. 17p. (DREO-TN—83-25). NTIS, PC A02/MF A01.

Abstract in French.

State-of-the-health analysis of Nickel-Cadmium aircraft batteries rejected as being unsatisfactory by CF bases has shown that most of the problems encountered can be related to the fact that the KOH concentration in the cells is too low and/or the carbonate concentration is too high. Exchange of electrolyte restored the performances of the cells but is time consuming, one to two weeks for a battery using the charge-KOH exchange-discharge procedure. The present technical note describes some of the tests performed and a procedure for rapidly exchanging the electrolyte in 22 AH Nickel-Cadmium Aircraft Celgard cells.

49912 **(DOE/SF/10501—014) Metallic-rectifier battery chargers for lead-acid batteries. Specification No. A10-1976 (Revision of A10-1972).** (Southern California Edison Co., Rosemead (USA)). 1 Jun 1976. Contract FC03-77SF10501. 18p. (STMPO—491). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001376.

The specification provides general and technical requirements for metallic-rectifier battery chargers for lead-acid batteries, including service conditions, conformance to national standards, output voltage and output voltage control, transient voltage surge, ripple voltage, sound level, components, temperature rise, cabinets, painting, nameplates, testing, packaging and shipping. General conditions covering the supply of the battery chargers, such as patents, insurance, and changes to the specification. Requirements are given for drawings to be furnished with proposal and for review, final drawings, instruction books, and further information to be furnished with the proposal. (LEW)

49913 **(NMAB—390) Assessment of research needs for advanced battery systems.** (National Materials Advisory Board (NRC), Washington, DC (USA)). 1982. Contract AC01-78ET26946. 196p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE85000733.

The materials-related research needs for advanced rechargeable storage battery systems have been assessed. Both aqueous and non-aqueous systems, to be used primarily in electric vehicles and electric-utility load-leveling applications, were examined. It is concluded that research is needed on a wide spectrum of components and processes to improve the performance of such systems. Additionally, many of the problems are common to several types of battery cells; research on these generic problems warrants special priority. An overview of the state of the art is provided along with a summary of recommendations, particularly concerning generic problems with storage batteries but also including those unique to individual systems. An outline of research needs is presented; this includes specific basic and applied research approaches for the solution of the major problems with the various battery systems. The committee also recommends that the United States require an increase in university output of scientists and engineers trained in electrochemistry and materials sciences. Reports on specific storage battery systems, authored by members of the study committee and associated panels, are also included.

49914 **(NP—4770521) Contribution to the description of the electrical behaviour of lead, nickel-cadmium, and nickel-iron accumulators.** Schleuter, W. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Elektrotechnik). 19 Nov 1982. 226p. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE84770521.

The construction, mode of operation and fundamental equations of reaction of the accumulators are described. Measuring methods are presented which enable drops in voltage caused by different behaviour patterns over time to be analysed. The most important electrical equivalent circuits for accumulators known to date are described together with their advantages and disadvantages. Operational behaviour of accumulators during discharging with various constant currents are studied. The dependence of achievable degree of discharge, withdrawable energy, the mean voltage, and energetic efficiency on the discharge current is established.

49915 **Defects and disorder in the fast-ion electrode lithium-aluminum.** Brun, T.O.; Jorgensen, J.D.; Misawa, M.; Rotella, F.J.; Susman, S.; Mildner, D.F.R. (Argonne National Lab., IL). *Journal of the Electrochemical Society;* **129**: No. 11, 2509-2512(Nov 1982).

The fast Li-conducting intermetallic compound, β-LiAl, crystallizes in the Zintl structure (B32 prototype: NaTl). A high concentration of constitutional vacancy defects is responsible for the Li conduction. The lattice constant, thermal parameters, and the order parameter have been determined by neutron diffraction as a function of temperature. The results show a high concentration of anti-site defects (both Li on the Al sublattice and Al on the Li sublattice) at elevated temperatures. The high concentrations of vacancies and anti-site defects suggest a very complex conduction mechanism at elevated temperatures.

49916 **(UCRL-Trans—11989) High capacity batteries based on aluminum/oxygen cells.** Katryniok, D.; Ruch, J.; Schmoede, P. Translated from *ETZ, Elektrotechnische Zeitschrift ;* **102**: No. 21, 1094-1095(1981). Contract W-7405-ENG-48. 10p. NTIS, PC A02/MF A01. File Number DE84016066. DE84016066

Due to the high theoretical energy content of the electrochemical reaction of aluminum with oxygen (8 040 Wh/kg Al according to the following reaction equation), the use of this system for producing current is investigated by different working groups. Acidic, neutral, and weakly alkaline electrolytes were used in addition to strongly alkaline electrolytes. High capacity and high energy batteries can be built with aluminum/oxygen cells in strongly alkaline electrolytes, which have a particularly high energy content at low energy cost for a surface power density of 1 W/cm^2.

29 ENERGY PLANNING AND POLICY

49917 **(CONF-830179—Vol.2) Energy: challenges and opportunities for the Middle Atlantic United States. Volume 2. Background articles.** (Johns Hopkins Univ., Baltimore, MD (USA). Energy Research Inst.). 1983. 276p. D. File Number TI84901918.

From Energy: challenges and opportunities for the Middle Atlantic United States symposium; Baltimore, MD, USA (10 Jan 1983).

A symposium on Energy: challenges and opportunities for the Middle Atlantic United States was organized by the Johns Hopkins University Energy Research Institute and held at the Mudd Hall Auditorium, The Johns Hopkins University, 10 to 11 January, 1983. All ten papers in Volume 2 (Background Articles) of the proceedings have been entered individually into EDB, ERA and EAPA. (LTN)

49918 **(N—84-21977) Energy: a continuing bibliography with indexes, issue 40, January 1984.** (National Aeronautics and Space Administration, Washington, DC (USA)). Jan 1984. 212p. (NASA-SP—7043(40)). NTIS, PC A10/MF A01.

This bibliography lists 775 reports, articles and other documents introduced into the NASA scientific and technical information system from October 1, 1983 through December 31, 1983.

2901 Energy Analysis And Modeling

REFER ALSO TO CITATION(S) 29010049457, 49461

49919 **(EIR—516) Cost-optimized energy supply scenarios for Switzerland and their political marginal conditions.** Kypreos, S. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Apr 1984. 67p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE85750067.

In EIR report number 485, "Modal Splits for the Swiss Energy Supply to the year 2000" the system analysis group of the section prospective studies of the Eidgenoessisches Institut fuer Reaktorforschung (EIR) contributed its part to the discussion of the "Intervention-Free Development of the Swiss Energy Supply to the year 2000". In the present study that work is also applied to scenarios making allowance for interventions. Considering certain assumptions on the development of energy prices and the gross national product, and starting from scenarios calculating the energy requirements which were made up by the University of Geneva (CUEPE, Centre Universitaire d'Etude des Problemes de l'Energie), the task consisted in determining the shares of the different energy sources and energy technologies in the Swiss energy supply (Modal Splits). It was solved by application of the Linear Optimization Program MARKAL.

49920 **(SLU-ISK—153) Optiflow. Description of a system for regional analysis of flow and utilization of forest raw materials, and one method of application.** Delhen, R.; Liljeblad, H.; Nilsson, S. (Sveriges Lantbruksuniversitet, Garpenberg. Institutionen foer Skogsteknik). 1983. 94p. (In Swedish). NTIS (US Sales Only), PC A05/MF A01. File Number DE84751655.

In this report we will describe a system for regional analyses of flow and utilization of forest raw material and also applications of this system. The flow of material to the forest industry has changed considerably in the last 10 years. There are many reasons for this. e.g. changed marketing conditions, different production direction and increased specialisation. Competition for the forest products has increased drastically at the same time. This is true between different branches in industry and between particular industries. This situation of competition is enforced also by the increased interests in forest products for fuel due to the oil crises in the 1970s. It is important in this situation, to be able to make analyses of what ought be a reasonable distribution of the forest raw material to different interested parties. The Department of Operational Efficiency has, for this reason, initiated development of a system for regional analyses of this kind.

2902 Economics And Sociology

REFER ALSO TO CITATION(S) 29020049437, 49455, 49458, 49461, 49479, 49480, 49484, 49934, 49945

49921 (CONF-830179—Vol.2, pp 72p, Paper 2) **Post-war energy economics: the urban and regional implications.** De Vaul, D.; Montel-Cohen, T.; Clark, J.; Prestidge, J.R. (Northeast-Midwest Inst., Washington, DC). 1983. D. File Number TI84901918.

From Energy: challenges and opportunities for the Middle Atlantic United States symposium; Baltimore, MD, USA (10 Jan 1983).

This article has information which may be difficult to find in one place. Financial incentives for production of coal, oil, natural gas, hydroelectric and nuclear industries are listed. These have benefited mainly the producing states. Similarly, tax breaks and exemptions are given for electric utilities. Also, residential tax credits are given (for energy conservation and energy efficiency). The significance of rising energy prices for residential heating in cities and the effects are discussed in some detail; this is then repeated for the commercial and industrial sector. The actual energy consumption for each economic sector in 1978 is given. Finally, the energy policies of the Reagan administration are presented in detail. (LTN)

49922 (CONF-830179—Vol.2, pp 53p, Paper 7) **How will high energy costs affect social forms and patterns: relationships between energy-conservation, transportation, and spatial structures.** Robinson, I.M. (Univ. of Calgary, Alberta). 1983. D. File Number TI84901918.

From Energy: challenges and opportunities for the Middle Atlantic United States symposium; Baltimore, MD, USA (10 Jan 1983).

In this paper, the impacts of rising energy costs and/or uncertain supplies on spatial structures are examined from the standpoint of likely consumer behavior and of potential public policies. Specifically, two basic questions are addressed: (1) from the standpoint of expected consumer and business behavior, what are the likely impacts (if any) of rising energy prices and/or uncertain supplies on spatial structures - at the metropolitan and regional levels. More specifically, are these energy changes apt to continue or reverse recent population deconcentration trends; (2) from the standpoint of potential public policy, what are the best or desired energy-efficient spatial structures - again in terms of the two levels of concern in this paper, and what steps may be taken to encourage the desired pattern. While the benefits of energy conservation by appropriate land use and settlement arrangements are clear, the costs of and problems involved in, conservation are often not fully considered. Energy efficiency and energy conservation are, without doubt, important, but the achievement of these objectives by changes in land use and spatial structures involves several difficult issues and potential conflicting objectives.

49923 **(DOE/IG—0211) Revenues derived from work performed for non-federal entities.** (USDOE Office of Inspector General, Washington, DC). 17 Oct 1984. 30p. TIC, PO Bx 62, Oak Ridge, TN 37831. File Number TI85000917.

Report to The Secretary.

An audit was made at three field offices and one power marketing administration of selected Fiscal Year 1982 transactions for the primary purpose of determining whether the Department of Energy (DOE) was being properly reimbursed for the cost of work performed for non-Federal entities. A secondary purpose was to determine whether the Department was prefinancing this type of work when other funding arrangements were available and prescribed for use. Audit work was performed at the Albuquerque Operations Office in Albuquerque, New Mexico; the Nevada Operations Office in Las Vegas, Nevada; the Richland Operations Office in Richland, Washington; and the Western Area Power Administration in Golden, Colorado. During Fiscal Year 1982, these four field locations performed $44.2 million of work for non-Federal entities under an estimated 275 contractual arrangements. Our audit covered 19 of these arrangements under which $30.1 million of work was performed that year. It was found that cost accounting systems were adequate to identify and capture direct and indirect costs related to the work being performed, but that these costs were not being fully recovered. All revenues earned were not being billed and funding arrangements and billing and collection procedures were not always in compliance with applicable laws and regulations. About $4 million of additional revenue should have been collected on work performed for others. It was recommended that corrective action include enforcing a process of monitoring waivers of revenues earned and updating and thereafter keeping current, added factor rates used in pricing work for others and developing such rates for those organizational elements acquired since 1977.

49924 (INIS-mf—9052, pp 25) **Methods and models for system assessment of long-term development of energy complex of People's Republic of Bulgaria.** Tsvetanov, P.; Badeva, V.; Rujcheva, M.; Jordanov, P. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). 1983. (In Bulgarian). NTIS (US Sales Only), PC A99/MF A01. File Number TI84780548. (CONF-8309253—Absts.).

From 1. national congress of the physicists in Bulgaria; Sofia, Bulgaria (28 Sep 1983).

Published in summary form only.

49925 **(NISK/R—5/83) Economic evaluation of a district heating plant in Trysil.** Lunnan, A.: Sandberg, E. (Norsk Inst. for Skogforskning, Aas). 1983. 60p. (In Norwegian). NTIS (US Sales Only), PC A04/MF A01. File Number DE84751646.

A local district heating based on bark and chips in connection with a saw-mill in Trysil started in December 1980. The plant supplies 19 consumers with hot water. Investment amounted to about 10 mill NOK. The external heat sale was in 1980/81 6.1 mill kWh. The internal consumption was 10.2 kWh. The consumer price was based on oil prices and was for 1980/81 0.182 NOK/kWh. All figures are given in 1980 prices. Profitability calculations show a level of 2.6 mill NOK at 10% real discount rate. Internal rate of return before subsidies is about 11%. A sensitivity analysis show a real variation of the internal rate of return between 6-18%. The critical factors for the profitability is wear life of the plant, price of bark, relative change in oil prices and the internal heat sale's price. The cash flow may become negative in the first few years. Real rate of profit of equity is calculated to 27% assuming a 10% yearly inflation and no loan interest adjustment. Macroeconomical profit for the district heating plant is calculated to be higher than the microeconomical due to a higher macroeconomical energy price. Sensitivity analysis show a real rate of return of 9-31% which is very good and close to those in the North Sea. Chips and logging residues might also be used in the plant but at present this is too expensive. Bark and saw-mill residues are cheapest. Lastly it is discussed why so few district heating plants are built in Norway. The profitability seems satisfactory, but investors cannot manage the financing and liquidity problems. Organizational problems and raw material supply problems exist. In addition Norway still has cheap hydroelectric power. 13 drawings, 25 tables.

49926 **(NSF—81-305) Problems of small, high-technology firms.** Stewart, W.L.; Friedman, N.W. (National Science Foundation, Washington, DC (USA). Div. of Science Resources Studies). Dec 1981. 40p. National Science Foundation, Washington, DC 20550. File Number TI84901910.

This report is based on a mail survey conducted by NSF near the end of 1977. Of the 13,000 questionnaires mailed to high-technology firms in the United States believed to be engaged in R and D activities, there were 1232 usable responses. The primary criterion for inclusion in the survey was the number of employees of each company in 1976 - fewer than 500 for manufacturing firms and fewer than 100 for nonmanufacturing firms. The survey was followed by a series of in-depth interviews in 1979 of 71 of the participating firms. Various overall industry expenditure and personnel data cited in the text and charts are based on 1971 and 1976 data from the annual NSF survey of research and development in industry. The data are shown to provide perspective on the level of activity in small, high-technology firms relative to all R and D-performing companies. The latest year for which such data are available for small firms is 1976.

2903 Environment, Health, And Safety

REFER ALSO TO CITATION(S) 29030049935, 49936, 50432, 50531, 50537, 50544, 50571, 50573, 50580, 50582

49927 **(DOE/EV/10472—T4) Discussion of policy issues in implementing environmental legislation.** (ERT, Concord, MA (USA)). 1983. Contract AC01-81EV10472. 41p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85000725.

This report discusses several policy issues in the implementation of two environmental regulations by the Environmental Protection Agency (EPA). Often, the scientific assumptions that were made during the enactment of legislation are overtaken by advances in scientific knowledge or are changed when, broadly speaking, the legislatively-imposed paradigm cannot be supported by the scientific community. This report examines these questions by focussing on three examples. Two represent issues related to the Clean Air Act and one represents an issue relevant to the Clean Water Act. The three examples are: (1) EPA's review of health effects literature and incorporation of thresholds in setting National Ambient Air Quality Standards; such thresholds are assumed to exist in the Clean Air Act; (2) the ability to determine whether or not an air quality con-

trol region (AQCR) or any other jurisdiction has attained or not attained ambient standards under the Clean Air Act; and (3) under the Clean Water Act, the ability to determine whether the regulation of thermal discharges will provide for the protection and propagation of balanced, indigenous species. In each of these examples, Congress made several assumptions which are not scientifically supportable. Afterwards EPA recognized these shortcomings; this report discusses the Agency's approach to each situation. 20 references. (ACR)

49928 **(GAO/RCED—84-44) Federal efforts to control the environmental and health effects of synthetic fuels development.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 9 Mar 1984. 51p. General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760. File Number TI84901489.

Report to The Chairman, Subcommittee on Fossil and Synthetic Fuels, Committee on Energy and Commerce, House of Representatives.

Because the synthetic fuels industry is still relatively new with no commercial-scale projects initiated under the Energy Security Act operating successfully in the United States, many uncertainties exist concerning the environmental and health effects of industry emissions. The Environmental Protection Agency (EPA) and states regulate some synthetic fuels emissions through a process that requires project sponsors to obtain permits to construct and operate their projects. However, information on the environmental and health effects of other potentially harmful emissions - some of which may be carcinogenic - is needed from commercial-scale synthetic fuels projects before EPA will make regulatory decisions on these emissions. The Synthetic Fuels Corporation, which provides financial assistance for synthetic fuels projects, requires that an environmental monitoring plan be established for each project. The Corporation will establish Monitoring Review Committees to review the data generated from these plans. The data could provide the information needed for determining whether additional research and regulatory actions are needed.

49929 **(GAO/RCED—84-79) EPA's innovative technology program for waste water treatment needs better controls.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 20 Aug 1984. 63p. General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760. File Number TI85900199.

The Environmental Protection Agency (EPA), which makes grants to municipalities to build sewage treatment plants, gives financial and other incentives to municipalities which use more efficient, innovative sewage treatment technologies in their plant projects. GAO reviewed 70 projects approved for innovative technology program funding in 11 states located in three EPA regions. GAO questioned whether 24 of the projects were technologically innovative; 14 projects could not be assessed because of insufficient information; and 32 projects appeared to be innovative. EPA awarded bonuses totaling $20.2 million to the projects which were questionable and $7.3 million to the projects which could not be assessed. Project engineers in two of the three regions generally did not ensure that projects were innovative. Designed to break down the barriers hindering development of innovative technology in wastewater treatment, the program has had limited success. The program does not provide sufficient incentives for consulting engineers and states to take the risk or incur the additional cost of developing innovative projects. GAO recommends several actions to improve compliance with program objectives. GAO also recommends that EPA seek to establish a demonstration program which would allow it to select promising technologies for communities willing to accept the technologies, directly fund construction and start-up costs, and evaluate operation and project results.

49930 (INIS-mf—9053, pp 61-69) **Medical inspection according to the new nuclear power law.** Ligteringen, J. (Directoraat-Generaal van de Arbeid, Voorburg (Netherlands)). 1982. (In Dutch). NTIS (US Sales Only), PC A05/MF A01. File Number TI85780001. (CONF-820199—).

From Occupational health aspects of ionising radiation meeting; Amsterdam, Netherlands (6 Jan 1982).

Industrial medicine is an underdeveloped discipline in the Netherlands. The author surveys the discrepancies between the laws regulating health protection by medical inspection, reporting and evaluation, and the laws concerning these points when work with radioactive materials or apparatuses producing ionising radiations is involved. Points to be cleared up are presented.

49931 (INIS-mf—9053, pp 70-79) **Radioactive materials decree and the radiation apparatus decree in the nuclear energy law.** Vlaskamp, L. (Directoraat-Generaal van de Arbeid, Voorburg (Netherlands)). 1982. (In Dutch). NTIS (US Sales Only), PC A05/MF A01. File Number TI85780001. (CONF-820199—).

From Occupational health aspects of ionising radiation meeting; Amsterdam, Netherlands (6 Jan 1982).

A short introduction is presented to the new sets of regulations concerning the use of radioactive materials and work with apparatuses producing ionising radiations, which were drawn up to bring the Netherlands' Regulations in agreement with the Euratom basic standards. Appendices contain a survey of the new units to be used, the regulations as proposed, the Euratom category classification, a global Dutch one, a list of concepts and notions, and a table of old and new units in radiation protection programmes.

49932 **(LA-UR—84-2815) Safety analysis and review system (SARS).** Graf, J.M.; Lopez, J.J. (Los Alamos National Lab., NM (USA); USDOE Assistant Secretary for Policy, Safety and Environment, Washington, DC. Office of Operational Safety). 1984. Contract W-7405-ENG-36. 20p. (CONF-840963—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85002020.

From DOE and DOE contractors' occupational safety and health conference; San Diego, CA, USA (11 Sep 1984).

The basic requirements and responsibilities outlined in DOE Order 5481.1A are described. The status of Office of Operational Safety evaluation of existing programs and the assistance being provided by Los Alamos, and anticipated evaluation activities are discussed. (ACR)

2904 Natural Resources

REFER ALSO TO CITATION(S) 29040049745

2905 Research, Development, Demonstration, And Commercialization

REFER ALSO TO CITATION(S) 29050049622, 50525, 50761

49933 **(EPRI-NP—3632) Operation of the EPRI Nondestructive Evaluation Center. 1983 annual report.** Nemzek, T.A.; Stone, R.M.; Schoenecke, P.L.; Ammirato, F.V.; Becker, F.L.; Behravesh, M.; Brown, S.D.; Pherigo, G.L.; Wilson, G.H. III. (Jones (J.A.) Applied Research Co., Charlotte, NC (USA)). Jul 1984. 90p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920546.

This report describes the Electric Power Research Institute (EPRI) funded nondestructive evaluation (NDE) project activities carried out by the J.A. Jones Applied Research Company. The primary support for this project is provided through Contract RP 1570-2 with supplementary funding provided by interested EPRI Owners' Groups. The purpose of the project is to design, construct, organize, staff, equip and operate a dedicated facility for providing improved and field qualified NDE equipment, procedures, and personnel training to the electric utility industry. The entire scope of this work is presented with major emphasis placed on the activities in 1983, the second full year of operation in the Nondestructive Evaluation Center facility. The NDE Center is providing a bridge to transfer useful research and development results to routine field application. This is being accomplished through qualification and refinement for field use of equipment and techniques developed in EPRI sponsored and other related projects, realistic training of utility designated personnel and organization of greater involvement of the academic community in NDE education. Significant assistance has been provided to the electric utility industry under this project

in the form of improved, field ready NDE equipment and procedures; critically needed documentation on present inspection method capability; mechanisms for demonstrating the effectiveness of techniques being used; rapid response assistance for critical, short-term problems; and training for generic industry needs.

2906 Nuclear Energy

REFER ALSO TO CITATION(S) 29060049512, 49546, 49790, 49791, 49792, 49795

49934 (DOE/PE/70025—T1) Nuclear Regulatory Commission's antitrust review process: an analysis of the impacts. (TRANSCOMM, Inc., Falls Church, VA (USA)). Jun 1981. Contract AC01-79PE70025. 282p. NTIS, PC A13/MF A01; GPO Dep. File Number DE85000061.

The Nuclear Regulatory Commission's (NRC) antitrust process is reviewed and its impacts to small systems and applicant systems are studied. This process takes the form of a description of the NRC's antitrust review process as implemented, a generic categorization of potential impacts and individual case-by-case studies of four different utilities.

49935 (INIS-mf—9042) Putting risk analysis into perspective: a comparative review of major societal risk studies of nuclear power. Dooley, J.E.; Hansson, B.; Kaspersson, R.; ORiordan, T.; Paschen, H. (Royal Swedish Academy of Sciences, Stockholm. Beijer Inst.). Apr 1983. 68p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85780009.

The emphasis in this final report of the project Evaluation of major Swedish energy risk assessments in an international perspective is shifted towards the comparative aspect. The comprehensive nuclear risk study has been used as an instrument to satisfy many needs simultaneously. The research consisted of an examination of existing risk studies of five nations, namely West Germany, UK, US, Canada and Sweden. The effect of nuclear risk studies on society at large and on public attitude towards nuclear power in particular is discussed. Finally, the effect on the nuclear establishment is analysed.

49936 (INIS-mf—9043) Impact of risk studies. Hansson, B. (Royal Swedish Academy of Sciences, Stockholm. Beijer Inst.). 1984. 79p. NTIS (US Sales Only), PC A05/MF A01. File Number DE85780010.

The report is a summary of the reports of various subprojects on nuclear safety. The purpose of the study was to evaluate the role and usefulness of major risk studies in societal opinion forming and decision making processes. The primary research material consisted in seven major risk studies, three of which were concerned with radioactive waste handling, two with reactor safety and two with comparative studies of various sources of energy. Special attention was given to the following four aspects: (a) the way in which the studies were interpreted, (b) the extent to which these studies have clarified the risks they analyse, (c) the extent to which these studies have narrowed the scientific debate and (d) the degree to which these studies have actually influenced safety measures and regulatory policy. The picture which emerges is one of success in relation to the effects on the nuclear establishment and largely a failure as attempts at settling disputes and informing the public.

49937 (SAND—84-1665C) Process evaluation of the human reliability data bank. Miller, D.P.; Comer, K. (Sandia National Labs., Albuquerque, NM (USA); General Physics Corp., Columbia, MD (USA)). 1984. Contract AC04-76DP00789. 10p. (CONF-8410142—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016722.

From 12. water reactor safety research information meeting; Gaithersburg, MD, USA (23 Oct 1984).

The US Nuclear Regulatory Commission and Sandia National Laboratories have been developing a plan for a human reliability data bank since August 1981. This research is in response to the data needs of the nuclear power industry's probabilistic risk assessment community. The three phases of the program are to: (A) develop the data bank concept, (B) develop an implementation plan and conduct a process evaluation, and (C) assist a sponsor in implementing the data bank. The program is now in Phase B. This paper describes the methods used and the results of the process evaluation. Decisions to be made in the future regarding full-scale implementation will be based in part on the outcome of this study.

2907 Transport And Storage

REFER ALSO TO CITATION(S) 29070049435

2908 Waste Heat Utilization

REFER ALSO TO CITATION(S) 29080049925, 50056

49938 (N—84-22001) Assessment of advanced technology for industrial cogeneration. Moore, N. (Jet Propulsion Lab., Pasadena, CA (USA)). Jun 1983. 139p. (NASA-CR—173456; JPL-PUB—83-66). NTIS, PC A07/MF A01.

The potential of advanced fuel utilization and energy conversion technologies to enhance the outlook for the increased use of industrial cogeneration was assessed. The attributes of advanced cogeneration systems that served as the basis for the assessment included their fuel flexibility and potential for low emissions, efficiency of fuel or energy utilization, capital equipment and operating costs, and state of technological development. Over thirty advanced cogeneration systems were evaluated. These cogeneration system options were based on Rankine cycle, gas turbine engine, reciprocating engine, Stirling engine, and fuel cell energy conversion systems. The alternatives for fuel utilization included atmospheric and pressurized fluidized bed combustors, gasifiers, conventional combustion systems, alternative energy sources, and waste heat recovery. Two advanced cogeneration systems with mid-term (3 to 5 year) potential were found to offer low emissions, multi-fuel capability, and a low cost of producing electricity. Both advanced cogeneration systems are based on conventional gas turbine engine/exhaust heat recovery technology however, they incorporate advanced fuel utilization systems.

49939 (N—84-22005) Advanced cogeneration research study. Executive summary. Bluhm, S.; Moore, N.; Rosenberg, L.; Slonski, M. (Jet Propulsion Lab., Pasadena, CA (USA)). Jun 1983. 21p. (NASA-CR—173467; JPL-PUB—83-67). NTIS, PC A02/MF A01.

This study provides a broad based overview of selected areas relevant to the development of a comprehensive Southern California Edison (SCE) advanced cogeneration project. The areas studied are: (1) Cogeneration potential in the SCE service territory (2) Advanced cogeneration technologies; and (3) Existing cogeneration computer models. An estimated 3700 MW sub E could potentially be generated from existing industries in the Southern California Edison service territory using cogeneration technology. Of this total, current technology could provide 2600 MW sub E and advanced technology could provide 1100 MW sub E. The manufacturing sector (SIC Codes 20-39) was found to have the highest average potential for current cogeneration technology. The mining sector (SIC Codes 10-14) was found to have the highest potential for advanced technology.

49940 (N—84-22006) Cogeneration computer model assessment: advanced cogeneration research study. Rosenberg, L. (Jet Propulsion Lab., Pasadena, CA (USA)). Jun 1983. 43p. (NASA-CR—173453; JPL-PUB—83-59). NTIS, PC A03/MF A01.

Cogeneration computer simulation models to recommend the most desirable models or their components for use by the Southern California Edison Company (SCE) in evaluating potential cogeneration projects was assessed. Existing cogeneration modeling capabilities are described, preferred models are identified, and an approach to the development of a code which will best satisfy SCE requirements is recommended. Five models (CELCAP, COGEN 2, CPA, DEUS, and OASIS) are recommended for further consideration.

49941 **(N—84-22007) Survey of cogeneration: advanced cogeneration research study.** Slonski, M.L. (Jet Propulsion Lab., Pasadena, CA (USA)). Jun 1983. 59p. (NASA-CR—173454; JPL-PUB—83-40A). NTIS, PC A04/MF A01.

The consumption of electricity, natural gas, or fuel oil was surveyed. The potential electricity that could be generated in the SCE service territory using cogeneration technology was estimated. It was found that an estimated 3700 MWe could potentially be generated in Southern California using cogenerated technology. It is suggested that current technology could provide 2600 MWe and advanced technology could provide 1100 MWe. Approximately 1600 MWt is considered not feasible to produce electricity with either current or advanced cogeneration technology.

2910 Conservation

REFER ALSO TO CITATION(S) 29100049973, 50024, 50065, 50582

49942 **(BNL—35178) Energy management review.** (Brookhaven National Lab., Upton, NY (USA)). May 1984. Contract AC02-76CH00016. 39p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85001357.

Brookhaven's energy conservation accomplishments since the energy crunch started in 1973 are highlighted. The following are discussed: DOE energy management goals and objectives; BNL's energy management program, energy consumption, energy sources, and energy conservation studies; implemented energy conservation projects; proposed energy conservation projects; employee awareness program, vanpool, vehicular energy conservation, and energy consumption monitoring and analysis. (MHR)

49943 **(PNL—5244-Vol.1) Assessment of technical strengths and information flow of energy conservation research in Japan. Volume 1. Executive summary.** Hane, G.J.; Lewis, P.M.; Hutchinson, R.A.; Rubinger, B.; Willis, A. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1984. Contract AC06-76RL01830. 32p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85001734.

This document is a concise report of a study performed to build the groundwork for Office of Energy Systems Research (ESR) international monitoring efforts. The study explores the status of research and technology developments in Japan and the ability of US researchers to keep abreast of Japanese technical advances. Ten technology areas that can be applied to improving the efficiency of energy use and that are relevant to ESR research programs were examined.

2920 Supply, Demand, And Forecasting

REFER ALSO TO CITATION(S) 29200049436, 49454, 49470, 49478, 49925, 49954

49944 **(CONF-821286—1) Energy demand in the transportation sector of Mexico.** Berndt, E.R.; Botero, G. (Massachusetts Inst. of Tech., Cambridge (USA). Alfred P. Sloan School of Management). Feb 1983. 33p. Massachusetts Institute of Technology, 50 Memorial Drive, Cambridge, MA 02139. File Number TI85900032.

From North American Economics and Finance Association meetings; New York, NY, USA (28 Dec 1982).

In this paper we report results of our analysis of one component within overall Mexican energy demand, namely, the transport sector. In 1975, the share of transport energy demand in the national total was about 34%, and by 1980 it is estimated that this share was slightly greater than 37%. Within the Mexican transport sector, attention is focused on energy demand in the railroad, air transport, and motor vehicle modes. The approach is an econometric one with special emphasis placed on modelling the structure for each mode. Reasons for pursuing a more structural approach are simple but persuasive: An understanding of factors affecting energy demand in the transport sector is best obtained by considering explicitly both demand for the product (transport services) whose production or consumption involves energy usage, and the manner in which energy usage can be adjusted in producing the transport service. A related advantage of this structural approach is that it facilitates explicit analyses of policies that affect demand for energy indirectly (through demand for the transport services, such as passenger-kilometers, prices and national GDP), as well as those that may affect energy demand more directly (e.g., a gasoline tax). The structural framework can be described briefly as follows. For two of the modes we employ a two-stage approach where in the first stage demands for services from the particular transport mode (e.g., railroad freight, airline passengers, etc.) are modelled, and then in the second stage energy demand is treated as a derived demand from this transport service. For the motor vehicle mode, gasoline demand is treated as the produce of the utilization rate per vehicle times the total number of vehicles, and then both these components are related to economic and structural variables. Due to data limitations, demand for diesel fuel is modelled using a more reduced form approach. 9 references, 5 tables.

49945 **(CONF-830179—Vol.1) Energy: challenges and opportunities for the Middle Atlantic United States. Volume 1. Summaries and discussions.** (Johns Hopkins Univ., Baltimore, MD (USA). Energy Research Inst.). 1983. 194p. NTIS, PC A09/MF A01. File Number TI84901832.

From Energy: challenges and opportunities for the Middle Atlantic United States symposium; Baltimore, MD, USA (10 Jan 1983).

Six questions were posed and addressed at the Symposium: (1) has the energy shortage passed; (2) how is the region affected by energy shortfalls; (3) how rapidly can the production and use of eastern coal be expanded; (4) what alternate supply options (besides coal) are proving practical; (5) how cost effective and acceptable are new large-scale energy technologies; and (6) how will high energy costs affect social forms and patterns. Seven persons were invited to analyze these specific issues and submit formal papers on the subject. These papers comprise Volume 2 of this proceedings. This volume contains the discussion group comments on these topics as well as comments on the formal papers. Separate sessions were conducted for each question, and audience comments were recorded as well. (DMC)

49946 (CONF-830179—Vol.2, pp 14p, Paper 1) **Has the energy crisis passed.** Singer, S.F. (Univ. of Virginia, Charlottesville). 1983. D. File Number TI84901918.

From Energy: challenges and opportunities for the Middle Atlantic United States symposium; Baltimore, MD, USA (10 Jan 1983).

This economic analysis deals with USA and global aspects of energy supplies. The author (an economist) feels that the lines at gasoline stations in 1973 were at least partly a result of government policies. He feels the reaction to petroleum shortages and to OPEC was excessive (supported by the fact that energy independence and synthetic fuels projects have now been cut back). He expects the large change in price of petroleum in the early part of this period will lead to a reduced demand of approximately half the maximum demand (42 million barrels per day in 1978) due to conservation, improved efficiency of use, retrofitting of oil-fired boilers, etc. This reduced demand would normally result in a lower price, however, with sufficient supply reductions, mainly by Saudi Arabia, the price may be held near present levels. If OPEC production isn't cut sufficiently, there may be substantial price breaks. He does, however, expect that the foreseeable price will be insufficient to justify the exploitation of heavy oil and tar sand deposits. Toward the end of the century cheap oil will be depleted even in Arabia and oil prices will then be determined largely by its properties and the available alternatives, mainly coal, natural gas, and nuclear energy. (LTN)

49947 **(CONF-8208202—1) Low-cost approach to local government energy contingency planning.** Kochman, M.P.; Adams, M.L.; Dodrill, B. (Ohio Dept. of Energy, Columbus (USA)). 1982. 8p. Ohio Department of Energy, Columbus OH 43215. File Number TI84901798.

From NLC/NACo national conference on energy and local governments; Knoxville, TN, USA (29 Aug 1982).

The need for local-energy contingency planning by communities to provide response actions for energy shortages in the 1980's is discussed. It is the responsibility of local governments to provide: (1) fuel needs for fire, police, sanitation and other vital community services; (2) fuel needs for other vital areawide fuel users such as

schools, hospitals, food providers, etc.; (3) alternative transportation modes for employers and employees; (4) order and reason at the retail gasoline pump; and (5) monitoring of compliance with measures adopted by local and/or state governments. A number of low-cost activity options are provided. (DMC)

49948 **DOE (U.S. Department of Energy) proposes emergency fuel savings plan.** *Oil and Gas Journal;* **78**: No. 6, 39(11 Feb 1980).

In accordance with the Emergency Energy Conservation Act of 1979, DOE has proposed a nine-point standby federal emergency energy conservation plan. The Act also gives the President authority to impose national and state conservation targets in the event of an energy supply interruption, and under certain circumstances, to impose all or part of the standby federal plan in a state that does not meet its conservation goals. The standby measures involve requirements for: minimum automobile fuel purchases, odd-even motor fuel purchase, employer-based commuting and travel measures, speed limit enforcement, compressed workweek, vehicle use stickers (to facilitate the banning of vehicle operation on certain days), limitation of recreational watercraft use, public information program, and building temperature restrictions.

49949 **U.S. Department of Energy issues interim final rules and proposed rules on the standby Federal Emergency Energy Conservation Plan.** *Federal Register (Washington, D.C.);* **45**: No. 27, 8309, 8462-8517(7 Feb 1980).

The U.S. Department of Energy issues interim final rules and proposed rules on the Standby Federal Emergency Energy Conservation Plan as mandated by the Emergency Energy Conservation Act of 1979. The interim final rules require such energy-saving measures as public information, which could save 70,000-220,000 bbl/day of gasoline; minimum motor fuel purchases to $7 or 6.2 gal and $5 or 4.4 gal for vehicles with eight or more cylinders, and with less than eight-cylinder engines, respectively; odd-even motor fuel purchase restrictions; speed limits which could save 30,000-400,000 bbl/day of gasoline; and mandatory building temperature restrictions which could save 200,000-400,000 bbl/day of oil equivalent. The proposed rules are employer-based commuting, which could save 55,000 bbl/day of gasoline; the compressed workweek, which could save 300,000 bbl/day of gasoline; 1-3 day vehicle use restrictions, which could save 4-20% or 265,000-1,350,000 bbl/day of gasoline; and recreational watercraft restrictions, which could reduce motor fuel demand by about 35,000 bbl/day if applied to Sundays only and by about 85,000 bbl/day if applied to Saturdays and Sundays. Other energy-saving measures and their economic impacts are discussed. The interim final rules are effective as of 1/31/80. Comments on the proposed rules must be submitted by 3/12/80.

2930 Policy, Legislation, And Regulation

REFER ALSO TO CITATION(S) 29300049442, 49484, 49512, 49728, 49921, 49927, 49945, 50544, 50761

49950 **(NP—4770470) CSSR - energy situation 1980/81.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Jun 1982. 35p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE84770470.

The energy situation of the CSSR is reviewed on the basis of some relevant data. Its energy policy is commented on, and developments in electric power generation are described as well as the trends observed for the various energy sources. Figures are given on external trade and on the balance of payments.

2940 Fossil Fuels

REFER ALSO TO CITATION(S) 29400049411, 49413, 49425, 49435, 49436, 49437, 49442, 49443, 49443, 49449, 49449, 49454, 49455, 49457, 49458, 49459, 49461, 49467, 49467, 49470, 49473, 49478, 49479, 49480, 49484, 49748, 49946, 49953

49951 **(GAO/RCED—84-180) Naval Petroleum Reserve No. 1: an assessment of production alternatives.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 30 Jul 1984. 50p. US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760. File Number TI85900097.

Report to the Chairman, Subcommittee on Armed Services Investigations, Committee on Armed Services, House of Representatives.

Under existing legislation, every 3 years the President must decide whether to shut-in or continue production of the Naval Petroleum Reserve No. 1 (NPR-1) oil field at Elk Hills, California. The current authorization for production expires on April 5, 1985. GAO discusses the geologic, budgetary, local economic, and national security implications of three production alternatives for NPR-1: continued production, shut-in, and partial shut in. In addition, GAO discusses the advantages and disadvantages of establishing a Defense Petroleum Reserve, a crude oil reserve for the military, using part of the revenues from continued production at NPR-1 to fund it. During the course of its review, GAO found that production rates at Elk Hills may be too high, causing problems within the reserve that could decrease ultimate recovery of oil by about 139 million barrels. The Department of Energy plans to analyze this situation and, if need be, adjust the rate. 2 figures, 2 tables.

49952 **(PNL—5271) State Energy Price System: 1982 update.** Imhoff, K.L.; Fang, J.M. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1984. Contract AC06-76RL01830. 177p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE85001098.

The State Energy Price System (STEPS) contains estimates of energy prices for ten major fuels (electricity, natural gas, metallurgical coal, steam coal, distillate, motor gasoline, diesel, kerosene/jet fuel, residual fuel, and liquefied petroleum gas), by major end-use sectors (residential, commercial, industrial, transportation, and electric utility), and by state through 1982. Both physical unit prices and prices per million Btu are included in STEPS. Major changes in STEPS data base for 1981 and 1982 are described. The most significant changes in procedures for the updates occur in the residential sector distillate series and the residential sector kerosene series. All physical unit and Btu prices are shown with three significant digits instead of with four significant digits as shown in the original documentation. Details of these and other changes are contained in this report, along with the updated data files. 31 references, 65 tables.

2950 Hydrogen And Synthetic Fuels

REFER ALSO TO CITATION(S) 29500049438, 49959

2960 Electric Power

REFER ALSO TO CITATION(S) 29600049597, 49749, 49794, 49933, 49958, 49958, 49983, 49984, 49985, 49987, 49988, 49989, 49990, 49991, 49992, 49993, 50037, 50038, 50039, 50040, 50041, 50042, 50043, 50044, 50045, 50046, 50047, 50048, 50050, 50051

49953 **(GAO/RCED—84-168) Information on coal conversion activities at selected powerplants.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 12 Jun 1984. 9p. US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760. File Number TI84901899.

Status of programs administered by the Economic Regulatory Administration (ERA) for the conversion of electric utility boilers for coal use and on the future demand for and use of coal is presented. Forty-five boilers were either converted or are in the

process of being converted by 1988. It is projected that by 1995, coal-fired generation will account for 55 percent of the total kilowatt hours of electricity generated in the US. 2 tables. (DMC)

49954 **Need for new powerplants. Hearing before the Subcommittee on Energy Conservation and Power of the Committee on Energy and Commerce, House of Representatives, Ninety-Eighth Congress, Second Session on Congressional Research Service and Department of Energy Electric Utility Reports, February 7, 1984.** Washington, DC, USA; Government Printing Office (1984). 641p.

Thirteen witnesses testified at a hearing reviewing two reports on the need for additional power plants and on alternatives to electric service. The DOE report was criticized for relying on extrapolations of past demand, which is now considered unreliable as a guide. Among the witnesses were representatives of DOE and other government agencies, the electric utility industry, the National Governor's Association, utility regulators, the Natural Resources Defense Council, and Amory and Hunter Lovins. The testimony centered on appropriate forecasting of future power needs and the government's role in securing adequate supplies. Material submitted for the record follows the testimony.

2980 Consumption And Utilization

REFER ALSO TO CITATION(S) 29800049436, 49478, 50035

49955 **(DOE/CE—0101) Appendices A, B, and C of the methodology for life cycle cost analysis using average fuel costs.** (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC). Sep 1984. 61p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85000204.

The single present worth (SPW) factors for finding the present value of future nonfuel nonannually recurring amounts, such as replacement costs and salvage values, and uniform present worth (UPW) factors for finding the present value of nonfuel annually recurring amounts, such as routine maintenance costs, are presented. In each table the factors are given for both 7 percent and 10 percent discount rates, and the range of Study Periods covered is from 1 to 25 years. Modified uniform present worth discount (UPW) factors are presented for the 10 DOE regions and for the United States. The UPW factors are derived from the Energy Information Administration's projected real average fuel price indices for each of the 26 years from mid-1984 through mid-2009 for the 10 DOE regions and the United States. Tables present the mid-1984 average fuel prices and the projected average fuel price indices for the 10 DOE regions and for the United States. To derive these data, the Energy Information Administration (EIA) data with a base year of mid-1983 were converted to a base year of mid-1984 using the mid-1984 EIA price indices and the change in the Gross National Product Implicit Price Deflator from the Second Quarter of 1983 to the Second Quarter of 1984. The average fuel price escalation rates (percentage change annually compounded) for six selected periods from mid-1984 to mid-2009 for the 10 DOE regions and for the United States are presented.

49956 **(EPRI-EA—3622) Adapting state and national electricity consumption forecasting methods to utility service areas. Final report.** Swift, M.A. (Booz, Allen and Hamilton, Inc., Bethesda, MD (USA)). Jul 1984. 182p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920453.

This report summarizes the experiences of six utilities (Florida Power & Light Co., Municipal Electric Authority of Georgia, Philadelphia Electric Co., Public Service Co. of Colorado, Sacramento Municipal Utility District, and TVA) in adapting to their service territories models that were developed for forecasting loads on a national or regional basis. The models examined were of both end-use and econometric design and included the three major customer classes: residential, commercial, and industrial.

49957 **(GAO/RCED—84-22) Analysis of the financial health of the electric utility industry.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 11 Jun 1984. 69p. US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760. File Number TI84901871.

Report to the Chairman, Subcommittee on Energy Conservation and Power House Committee on Energy and Commerce.

This report analyzes the past, present, and future financial health of the investor-owned electric utility industry. The 1970's was a financially difficult period for the industry, with 1974 being a particularly poor year. Since 1973, unusually high debt and large construction programs during periods of inflation and high interest rates had a negative influence on the industry's financial health. Although individual regulatory factors were not found to have a significant relationship to the industry's overall financial health, regulation's influence is reflected in the industry's stable profit picture. After 1981, such indicators of financial health as the market-to-book-value ratio of common stock and the rate of return improved. Industry is acting to reduce debt and construction. If inflation and interest rates stay below previous levels, the industry's financial prospects should be more favorable during the 1980's as compared with the 1970's.

49958 **(TVA/PUB—84/73) Cost classification approaches in TVA cost-of-service methodology.** (Tennessee Valley Authority, Chattanooga (USA). Office of Power). Sep 1984. 26p. NTIS, PC A03/MF A01. File Number DE85900074.

This paper summarizes TVA's present approach to cost classification within the cost-of-service study framework and discusses possible alternative classifications for a number of items. It includes discussion of the costs associated with plant that TVA has cancelled and cost classification as it may relate to the value of the benefits of the hydro system which are allocated to the residential class. TVA welcomes comments on the matters discussed in the paper.

2990 Unconventional Sources And Power Generation

REFER ALSO TO CITATION(S) 29900049600, 49611, 49622, 49728, 49735, 50573

49959 **(DOE/CS/69095—3) Current alternative energy research and development in Illinois.** (Illinois Dept. of Energy and Natural Resources, Springfield (USA). Div. of Energy and Environmental Affairs). Dec 1983. Contract FG45-80CS69095. 217p. NTIS, PC A10/MF A01; GPO Dep. File Number DE85001005.

This directory constitutes an inventory of recent activities involving research, development and demonstration projects of nonfossil, nonnuclear energy sources. Projects discussed in the directory were either in process in November 1983 or had been completed after May 1983. Entries are arranged by broad subject categories and within each category, entries are alphabetical by the performing organization and alphabetical by title where there is more than one entry for an organization. Entries are indexed by title, contributor, research organization and project site. Reports on 101 alternative energy projects are included and fall into nine major categories. Nearly half of the projects involve bioenergy and a third are solar related. The topics with actual numbers of reports are as follows: Bioenergy, 45; Solar Heating and Cooling, 24; Solar Photovoltaics, 3; Solar Thermal and Advanced Technologies, 5; Geothermal and Ocean Thermal, 2; Wind Energy, 5; Waste Heat and Materials Recovery, 6; Energy Storage, 8; and Regulations, Surveys and Planning, 2.

49960 **(PB—84-214956) Biomass and regions: Series fast No. 14. Summary report.** Schepens, G.; Louveaux, F.; Buydens, C. (Commission of the European Communities, Luxembourg). 1983. 98p. (In French). (EUR—8554-FR). NTIS, PC E05/MF E05.

The impact of increased use of biomass in Europe has been studied with reference to six regions, four in Northern Europe and two in Southern Europe. For each region, an inventory of available biomass has been drawn up and medium term usage (1982/85-1990/

95) has been identified and quantified. Availability of biomass; availability of technology; economic viability, taking into account energy requirements, and structural, social, and institutional feasibility, are identified as major factors influencing the development of biomass usage. Economic effects of developing biomass usage are examined including its impact on employment. Possible subjects for research and development are suggested and recommendations are made for financial aid, standardization of policy, coordination of available information, and dissemination of the information to potential users.

30 DIRECT ENERGY CONVERSION

3005 Fuel Cells

REFER ALSO TO CITATION(S) 30050049340, 49388

49961 **(DOE/CS/54237—T1) Study of pipeline applications of fuel cells. Final report.** Wakefield, R.A.; Ciliano, R.; Dore, H.; Eklund, L.G.; Levy, A.; Burnett, R. (Mathtech, Inc., Princeton, NJ (USA); Williams Bros. Engineering Co., Tulsa, OK (USA); United Technologies Corp., East Hartford, CT (USA)). Aug 1980. Contract AC01-78CS54237. 216p. NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE85000051.

Technological and economical assessments of the use of fuel cells for supplying electricity for pipeline pumping or compression and cogeneration at natural gas compression stations are detailed. The assessment strategy and procedure is detailed. Economic screening analyses of alternative design were performed to assess the potential economic payoff. Conclusions and recommendations are given. (WHK)

49962 **(DOE/FE/60338—13) Phosphoric acid electric utility fuel cell technology development. Technical progress report No. 13.** Breault, R.D.; Briggs, T.A.; Congdon, J.V.; DeMarche, T.E.; Gelting, R.L.; Goller, G.J.; Luoma, W.L.; McCloskey, M.W.; Mientek, A.P.; O'Brien, J.J. (United Technologies Corp., South Windsor, CT (USA). Power Systems Div.). May 1984. Contract AC21-83FE60338. 49p. (FCR—6444F). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85001946.

The Department of Energy has initiated this program to advance electric utility cell stack technology and to reduce cell stack cost. The cell stack has a nominal 10-ft^2 active area and operates at 120 psia/405°F. The program comprises six parallel phases, which culminate in a full-height, 10-ft^2 stack verification test. Progress is detailed. Assembly of the second 10-ft^2 short stack was initiated. Over 11,100 hours and 30 thermal cycles have been accumulated on the 3.7-ft^2 30-cell stack at 120 psia and 400°f. Work was initiated on improved edge seals that increase cross-pressure tolerance to the 30 to 40 psi range. Initial trials with new powder transfer equipment indicate a 20 fold increase in powder transfer rate to the substrate forming machine. The fourth mold trial of 250 separator plates was completed. Edge waves in separator plates were reduced with increased restraining loads. (WHK)

49963 (DOE/METC—84-6, pp 43-64) **Status and update of the DOE Molten Carbonate Fuel Cell Program.** Gmeindl, F.D. Dec 1983. NTIS, PC A21/MF A01. File Number DE84000216. (CONF-8305112—).

From 3. annual contractors' meeting on contaminant control in hot coal derived gas streams; Washington, PA, USA (24 May 1983).

The US Department of Energy (DOE) Molten Carbonate Fuel Cell (MCFC) program is supporting four contractors and one national lab. Current program emphasis is on cell and stack technology development. The second United Technologies (UTC) subscale stack (1-foot square x 20 cells) with external manifolding revealed unexpected electrolyte loss and stack mechanical deformation problems. Recent work has concentrated on solving these problems as well as cathode dissolution and fabrication techniques. Scale-up and testing of a General Electric (GE) single cell with internal manifolding is under way following successful bench-scale cell tests. UTC and the Institute of Gas Technology (IGT) have identified a requirement to maintain fuel H_2S content below 1.0 ppM and have observed MCFC performance to recover from comparatively large H_2S excursions under certain conditions. The work scope at Energy Research Corporation (ERC) is being expanded from support in component development and improvement to include a lead role in reforming anode development. Argonne National Lab (ANL) is providing technical support to DOE management and is presently developing alternative cathode materials to avoid dissolution into electrolyte.

49964 (DOE/METC—84-6, pp 67-85) **Update of the sulfur tolerance of molten carbonate fuel cells.** Marianowski, L.G. (Inst. of Gas Tech., Chicago, IL). Dec 1983. NTIS, PC A21/MF A01. File Number DE84000216. (CONF-8305112—).

From 3. annual contractors' meeting on contaminant control in hot coal derived gas streams; Washington, PA, USA (24 May 1983).

Although molten carbonate fuel cell (MCFC) power plants have been under development since the late 1950's, the operating characteristics with gases derived from coal containing a wide range of elements other than C, H, and O, were not studied until the Energy Conversion Alternative Study (ECAS) was completed in the late 1970's. Since then, the work of each contractor (United Technologies, Institute of Gas Technology, General Electric, and Energy Research Corporation) has included some contaminant studies (primarily of sulfur compounds). The majority of the reported work appears to have been conducted by UTC and IGT. The results indicate that the MCFC requires removal of sulfur to a level variously reported as $\leqq$ 0.1 ppM to 10 ppM. Because of this wide variation and because of the added transport effects encountered when the anode exhaust is recycled to the cathode for CO_2 supply, a program was begun early in 1982 at the Institute of Gas Technology to quantify the effects of sulfur contaminants in coal-derived gases on the operation and materials of construction of molten carbonate fuel cells for the purpose of specifying the gas cleanup requirements. Results are reported.

49965 **(DOE/NASA—0017-2) Manual of phosphoric acid fuel cell power plant cost model and computer program. Final report.** Lu, C.; Alkasab, K.A. (Cleveland State Univ., OH (USA)). May 1984. Contract AI21-80ET17088. 37p. (NASA-CR—174720). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85001154.

Cost model of phosphoric acid fuel cell powerplant includes two parts: a method for estimation of fuel cell system capital costs, and an economic analysis which determines the levelized annual cost of operating the system used in the capital cost program. Cost estimates are prepared for a given powerplant based on the equipment specifications discussed in the previous report of the performance model. Costs were estimated by determining the actual capacities of the equipment and the existing cost data. Current costs of these equipments in the form expected to be used were obtained from the references. Total module cost can be obtained by multiplying the equipment cost by the Direct Cost Factor (DCF), Indirect Cost Factor (ICF), and Contingency Factor (CF). The levelized annual cost of an investment is defined as the minimum constant net revenue required each year of the life of the project to cover all expenses, the cost of money, and the recovery of the initial investment. This is the capital investment analysis approach commonly used by electric utilities. The cost model has been coded in Fortran programs with several input options. Mathematical formulation and program description will be discussed in this report. A sample problem will be presented to express the inputs and outputs.

49966 **Rotating disk electrode apparatus for the study of fuel cell reactions at elevated temperatures and pressures.** Mcbreen, J.; Ogrady, W.E.; Richter, R. (Brookhaven National Lab., Upton, NY). *Journal of the Electrochemical Society;* **131**: 1215-1216(May 1984). Contract AC02-76CH00016.

A rotating disk electrode apparatus for studying fuel cell reactions at elevated temperatures and pressures was described. Preliminary data for oxygen reduction in 89.5 percent H3PO4 at temperatures up to 205 C and pressures up to 7.6 A were provided. The Tafel slope was approximately 120 mV/decade and invariant

with temperature up to 175 C and pressures near atmospheric. Increasing the pressure to 3 A at 175 C caused the Tafel slope to decrease to a value of approximately RT/F. Above 3 A, the current was proportional to the oxygen pressure. A first order dependence with respect to oxygen pressure was suggested, as well as a mechanism change with increasing oxygen coverage of the platinum. 10 references.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

3201 Buildings

REFER ALSO TO CITATION(S) 32010049683, 49686, 49687, 49689, 49690, 49690, 49942, 50533

49967 **(BFR—94:1983) Collecting well in fine sediment as heat storage for a block of flats in Karlstad. A preliminary study.** Agerstrand, T.; Nilsen, J. (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1983. 33p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. File Number DE84751657.

The aim of the study is to elucidate technique and economy for the use of clay layers for heat extraction and storage in built up areas. The conditions for this is heat pump technique and water carried heat. Two types of collecting wells are considered: (1) a deep well with horizontal collectors, (2) a shallow well with pyramidal collectors. Theoretical calculations show that 65% of the energy stored can be regained in a time span of 5 years with a horizontal collecting well. The storage is then used 5 months a year, giving an effect of 90 kW. The study shows that the collecting well arrangement have to be large scale to be profitable. The heat source have to be close by and cheap, for example summer warm surface water, solar collector are probably to expensive.

49968 **(CONF-840954—7) House thermal envelope conservation optimization with respect to performance/economics.** Zehr, F.J. (Westminster Coll., New Wilmington, PA (USA); Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001547.

From 9. national passive solar conference; Columbus, OH, USA (23 Sep 1984).

The performance and economics of various residential thermal envelope energy conserving features are analyzed employing computer methods. Variations in external wall construction such as 2 x 4, 2 x 6, double-wall, and strapped-wall are treated. Variations in ceiling insulation, floor insulation, air/vapor sealing, number of window glazings, and window orientation are included. The house thermal envelopes vary from present average construction to the extremes in super-insulation. The analysis is done for eight US cities with a range of climate from International Falls to Atlanta. The space heating, space cooling, and water heating loads are determined for a particular thermal envelope for a certain city. Energy requirements are calculated for four space conditioning and water heating systems which include electrical resistance, electric heat pump, natural gas, and fuel oil. Life cycle costs (LCC) for a 25-year period are computed according to energy requirement, fuel price, fuel price escalation value, system installed capital and maintenance costs, and a 3% discount rate. Total LCCs take into account the incremental construction costs for the various thermal envelope conservation features. Simple payback periods and benefit/cost ratios for the 25-year period for five selected houses with respect to a reference house are also calculated.

49969 **(CONF-8403146—2) Comparison of energy storage systems in the United States chilled water versus two types of ice storage systems.** Fischer, H.C. (Fischer (Harry C.), Sun City Center, FL (USA)). 1984. Contract AC05-84OR21400. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001102.

From IEA workshop on latent heat stores; Stuttgart, F.R. Germany (5 Mar 1984).

Current US production non-storage heat pumps are compared to heat pumps using stored hot water and stored chilled water and to heat pumps using ice-on-coils as a means of using latent heat of fusion of water as a heat source. This equipment is also used as a means of stored cooling for air conditioning during hot weather. An ice-making heat pump which harvests ice as sheets of ice 3 to 4 times per hour and stores the ice in a large inexpensive bin is discussed. The advantages of such an ice-making heat pump to heat in cold weather and cool in hot weather is discussed as it relates to Electric Utility load management in different parts of the United States.

49970 **(DOE/CE/40654—T2) Energy management assistance for small and medium-size manufacturers. A first-stage evaluation of the 1983-1984 EADC program.** Maginn, J.C. (University City Science Center, Philadelphia, PA (USA)). Jun 1984. Contract FC01-83CE40654. 33p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85000480.

University City Science Center (UCSC), as manager of the Energy Analysis and Diagnostic Center (EADC) program, is responsible for periodically evaluating the performance of each EADC in helping small and medium-size manufacturers to conserve energy and reduce their energy costs. This report presents the results of the most recent evaluation of the work performed by the five EADCs in operation prior to 1984: Georgia Institute of Technology, Oklahoma State University, and the Universities of Dayton, Kansas, and Tennessee. It was based on in-person interviews of 54 such manufacturers that were conducted during March and April, 1984. Those manufacturers were selected to obtain a sample with diversity in the industries represented, the size of the plants, their mix of energy sources, and their locations. All together they represented 17 different industries (2-digit SIC codes), employed 6563 people, and had an aggregate 1983 sales volume of $586 million. At the conclusion of each interview, which consisted of 46 questions structured to elicit specific kinds of information, the manufacturer's representative was asked whether he considered the EADC program to be a good expenditure of taxpayers' money. In this study 98% of those interviewed replied that it was.

49971 **(DOE/CS/40091—T3) Implementation results and financial returns from EADCS' recommendations to conserve energy and control costs. Third phase, 1981-1983 program.** Kirsch, F.W. (University City Science Center, Philadelphia, PA (USA)). Sep 1984. Contract AC01-78CS40091. 45p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85000547.

When the implementation results from small and medium-size manufacturers served during phase three of the 1981 to 1983 Energy Analysis and Diagnostic Center (EADC) program are combined with those of the preceding phases, it is clear that five EADCs have been responsible for the implementation of $10,273,603/year in cost savings and 1952 billion Btu/year in energy conservation by 460 small and medium-size manufacturers. At the same time, these manufacturers have spent $11,665,638 in the private sector to achieve these cost savings, thereby giving an overall payback time of 1.14 years. However, the chief focus is on phase three of the 1981 to 1983 time period, during which 121 manufacturers considered the implementation of almost 700 individual measures. Those that are being implemented will conserve a little more than 445 billion Btu/year and save almost $2.6 million/year in energy related costs.

49972 **(DOE/CS/40091—T4) Energy management assistance for small and medium-size manufacturers. A third-stage evaluation of the 1981-1983 EADC program.** Maginn, J.C.; McCann, L.L. (University City Science Center, Philadelphia, PA (USA)). Jan 1984. Contract AC01-78CS40091. 33p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85000545.

To evaluate how effectively the Energy Analysis and Diagnostic Centers have assisted small and medium-size manufacturers to conserve energy and reduce its cost, the staff of University City Science Center visit and interview at least 30% of the manufacturers served by the program. This report presents the results of 74 such interviews, conducted between October and December of 1983, which - when added to the 112 reported at two previous times - brings the total interviewed to 39% of all those served

during the 1981 to 1983 period of the EADC program. The EADCs that provided this technological energy assistance are located at Georgia Institute of Technology, Oklahoma State University, and the Universities of Dayton, Kansas, and Tennessee. In selecting the manufacturers to be interviewed, the professional staff of UCSC's Center for Energy Management and Industrial Technology attempts to achieve a sample with diversity in the types of industry, the size of the plants, their energy sources, and their locations. Taken together, the 74 manufacturers interviewed for this report represented 17 different industries (2-digit SIC codes), employed 12,608 persons, and had an aggregate 1982 sales volume of $1.365 billion.

49973 **(DOE/CS/40091—T6) Implementation results and financial returns from EADCs' recommendations to conserve energy and control costs. Second phase, 1981-1983 program.** Kirsch, F.W. (University City Science Center, Philadelphia, PA (USA)). Jun 1984. Contract AC01-78CS40091. 39p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85000481.

The 190 small and medium-size manufacturers served during the second phase of the 1981-1983 Energy Analysis and Diagnostic Center program have implemented, or scheduled for implementation, about 1000 of the EADCs' recommendations that will conserve almost 954 billion Btu/year and save almost $5 million/year in energy costs. Those figures represent a 72% increase in Btus conserved and an 86% gain in dollars saved over the first phase of the program, even though the number of implementation reports was only 7% larger during the second phase than during the first. This report presents a detailed account of the energy conserving and cost saving implementations carried out by 175 manufacturers contacted by the EADCs within a year after each plant had received its report of an EADC's recommendations, based upon a site visit and an analysis of the plant's operations. (Implementation data from the other 15 manufacturers served were not yet sufficiently complete to be included in this report.) The aggregated results show that the manufacturers' implementation represents 77.7% of the total Btus and 73.6% of the total dollars recommended in the energy audit reports.

49974 **(DOE/CS/40091—T7) Effectiveness assessment visits. Energy Analysis and Diagnostic Centers, October-November 1981.** (University City Science Center, Philadelphia, PA (USA)). Nov 1981. Contract AC01-78CS40091. 18p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000476.

The management of the Energy Analysis and Diagnostic Center program includes the scheduling of periodic site visits to observe the operations and to assess the effectiveness of each EADC, including the staff's performance of an energy audit in an industrial plant. During October and November 1981, a series of these visits were made to EADCs located in the following institutions: University of Dayton, Department of Mechanical Engineering; Georgia Institute of Technology, Engineering Experiment Station; University of Kansas, Department of Mechanical Engineering; Oklahoma State University, School of Industrial Engineering and Management; and University of Tennessee, Department of Engineering Science and Mechanics. This report offers a collection of five individual reports prepared on the basis of the effectiveness assessment visit to each of these institutions. The purpose is to keep the Department of Energy's technical project manager informed of each EADC's progress, operating methods, and energy audit performance.

49975 **(DOE/CS/40091—T8) Energy management assistance for small and medium-size manufacturers. A first-stage evaluation of the 1981-1983 program.** Kirsch, F.W. (University City Science Center, Philadelphia, PA (USA)). Jun 1982. Contract AC01-78CS40091. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85000549.

This report presents an evaluation of the performance of 5 Energy Analysis and Diagnostic Centers (EADCs) during the first stage of the 1981 to 1983 phase of this program, which, during several preceding phases, has been providing technological energy assistance to small and medium-size manufacturers since 1976. This program, which is sponsored by the Department of Energy (DOE) and managed by University City Science Center (UCSC), operates through EADCs located at Georgia Institute of Technology, Oklahoma State University, and the Universities of Dayton, Kansas, and Tennessee. To carry out these evaluations, the management of 25 manufacturing plants selected by UCSC's Center for Energy Management and Economic Development were interviewed to achieve a sample with diversity in the industries represented, the sizes of the plants, their mix of energy sources, and their locations. In the aggregate, these plants represent 12 different industries, now employ 4096 people, and has a total 1981 sales volume of $651 million. The manufacturers' response to the energy audits is documented.

49976 **(DOE/CS/40091—T9) Implementation of energy conservation opportunities by small and medium-size manufacturers. Second phase, 1981-1983 EADC program.** Kirsch, F.W. (University City Science Center, Philadelphia, PA (USA)). Aug 1984. Contract AC01-78CS40091. 41p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85000482.

This report describes and analyzes the implementation experience of 175 manufacturers with about 1000 energy conservation opportunities (ECOs) recommended to them during the second phase of the 1981 to 1983 EADC program. Overall, the manufacturers implemented, or definitely scheduled for implementation, 748 ECOs that are estimated to conserve about 73% of the conservation and 74% of the savings recommended by the EADCs. To provide an insight on the characteristics of individual ECOs that were in fact implemented is the purpose of this report. To classify the ECOs systematically and permit their analysis, the DIECO system was used (Directory of Industrial Energy Conservation Opportunities, University City Science Center). Applying the DIECO system to the 748 implemented ECOs shows a strong resemblance between what had been recommended and what was implemented. For most of the DIECO major groups, there is less than a 1% difference between recommended and implemented shares of total conservation or savings. The principal differences were in the slightly smaller buildings and grounds group and in the somewhat larger values in the combustion group and in the substitution of alternate fuels for more expensive ones.

49977 **(DOE/CS/40091—T10) Program of direct energy conservation assistance for medium-size and small manufacturers. Energy Analysis and Diagnostic Centers, September 1981-September 1982.** (University City Science Center, Philadelphia, PA (USA)). Dec 1982. Contract AC01-78CS40091. 79p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85001614.

The achievements of the Energy Analysis and Diagnostic Center (EADC) program at the mid-point of the 1981 to 1983 operating period are presented. An accounting and an analysis of the Btu conservation and dollar savings identified by 5 EADCs while performing energy audits in the plants of 165 small and medium-size manufacturers are included. In addition, this report reviews the characteristics of the 742 energy conservation opportunities recommended for the 20 different industries served and considers their effectiveness, in Btus and dollars, for the specific energy sources to be conserved in particular industries. As part of the EADCs' periodic performance evaluation 48 of the manufacturers served were interviewed in person to find out how they perceived the program and how satisfied they are with the services received. Their responses are also recorded and analyzed in this report. Finally, this report concludes with a summary of the program's known educational benefits in the universities where the EADCs are located, the conferences and workshops held for the EADCs' past and potential clients, and the technical support and program management provided by the Science Center.

49978 **(DOE/CS/40091—T11) Implementation of EADCs' recommendations to conserve energy and save dollars (1981-1982).** Kirsch, F.W. (University City Science Center, Philadelphia, PA (USA)). Apr 1983. Contract AC01-78CS40091. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85000477.

Small and medium-size manufacturers are continuing to realize very attractive financial returns by implementing most of the

specific energy conserving and dollar saving measures recommended by the Energy Analysis and Diagnostic Centers that performed energy audits in their plants. This report documents and describes this implementation and also presents an analysis of its financial worth directly to the manufacturers and indirectly to the federal government, in the form of tax revenues generated by the incremental earnings of the private sector. A preceding report included an accounting and an analysis of the total Btu conservation and dollar savings identified by the 5 EADCs while performing energy audits in the plants of 165 small and medium-size manufacturers during that time. By contacting this same group of manufacturers again, the EADCs were able to evoke detailed responses from 125 of them about what they have implemented or scheduled for implementation. The data from these responses, including the associated benefits and capital costs, form the basis for this report. Because statistical tests show very similar patterns of energy sources and categories of use among the 125 respondents and the 165 plants, the implementation data are considered representative of all the plants. Also included are in-depth examinations of the rates of implementation found for energy conservation opportunities involving each of the energy sources and categories of energy use (production, services, HVAC, and housekeeping).

49979 **(DOE/CS/40091—T12) Energy management assistance for small and medium-size manufacturers. An evaluation of the EADC program.** Duke, L.D.; Kirsch, F.W. (University City Science Center, Philadelphia, PA (USA)). Jun 1983. Contract AC01-78CS40091. 29p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85000478.

The Energy Analysis and Diagnostic Center (EADC) program has now provided technological energy assistance in the plants of more than 700 small and medium-size manufacturers. The performance of each of the 5 EADCs, which are located at Georgia Institute of Technology, Oklahoma State University, and the Universities of Dayton, Kansas, and Tennessee is evaluated periodically. This report presents an evaluation of their performance during the intermediate stage of the 1981 to 1983 phase of the EADC program. Evaluations of EADCs' performance are based upon interviews with manufacturers served by the program who are chosen to achieve a sample with diversity in the industries represented, the sizes of the plants, their mix of energy sources, and their locations. The 112 manufacturers interviewed for this evaluation represent 19 different industries (SIC codes), now employ 16,896 people, and has a total 1982 sales volume of $1551 million. The energy audit and audit report appear to have had positive impacts upon virtually all the participating firms. Asked if the energy audit and the final report had helped them to understand their energy usage, 106 of these 112 manufacturers' representatives said yes; only 6 (5% of the sample) did not feel the audit added anything new to their understanding. There were 109 (97%) who expect to achieve energy and dollar savings as a result of the EADCs' activities.

49980 **(DOE/OR/21400—T47) Impact analysis speculations regarding the Pacific Northwest Power Planning Council prescriptive building standards applied to the public utilities service area new housing starts.** Hamblin, D.M. (Oak Ridge National Lab., TN (USA)). 16 Mar 1984. Contract AC05-84OR21400. 61p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85001093.

The following analysis comprises a case study of the Northwest Power Planning Council's mandated residential building standard scheduled for 1986 implementation in the Pacific Northwest. Impact analyses reported are for public utilities service territories which comprise approximately 45% of the region's residential service. The two primary conclusions of the case study are the following: (1) the standard is most probably not cost-effective relative to additional electric-power generation alternatives; (2) an all-fuels standard designed to stabilize market shares across space heating fuel-and-equipment choices imposes significant and possibly unwarranted excess burdens upon non-electric fuel users.

49981 **(DOE/R4/10484—T1) Biomass wood. Final technical report.** Elliott, A.H. (Elliott (Aubrey H.), Nichols, SC (USA)). 31 Dec 1983. Contract FG44-81R410484. 11p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000312.

This project supported an on going investigation to develop the commercial application of a multiple-use wood fired heater. As a result of the project, a production model heater has been designed and several units are undergoing performance testing: residental (three), hog parlor (one), community recreation center (one), and Pee Dee Experiment Station (two for tobacco curing tests). The present heater design uses a two-stage air-to-air heat exchanger with a total heating area of approximately 48 square feet and a furnace volume of approximately 18 cubic feet. The heater is rated at 100,000 Btu/hr, and heated air output is thermostatically controlled by the combination of on/off action of a fan moving air across the heated surface and open/closed action of a damper controlling combustion airflow into the furnace. At this time developmental work is directed toward overcoming the remaining obstacle to the immediate commercialization of the heater: controlled removal of excess furnace heat during relatively long no-heat demand periods or in the event of fan outage.

49982 **(DOE/R4/10499—T1) Building retrofit innovations. Final technical report.** (Center for Human Development, Jackson, MS (USA)). Dec 1983. Contract FG44-81R410499. 19p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001153.

The purpose of the grant was to demonstrate how a model energy conserving low income square block of people could be developed using part of the grant as a no-interest loan fund; staff and outside volunteers for technical aid and labor; and the recipient community as cooperative self-help labor. Early on it became clear that the conservtive nature of our low income target group insured that they would not experiment with wood heaters and solar panels. Furthermore, the level of cooperation we had anticipated to produce community interaction just was not there. That is when we rewrote our goals to weatherize homes inexpensively in order to save 100 to $200 a year on utility bills. Working with homeowners and neighbors to teach skills and accomplish the buttoning up of homes, we were successful in proving the energy cooperative concept in three neighborhoods, involving over 40 homes. Our success led to a contract with Mississippi Power and Light under which they pay for $200 materials and $50 overhead for us to weatherize low income homes.

49983 (EPRI-EA—3530, pp 8.1-8.12) **Residential load forecasting: intergrating end-use and econometric methods.** Braithwait, S.D. (Electric Power Research Inst., Palo Alto, CA). May 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920380. (CONF-830982—).

From National conference on utility conservation programs: planning, analysis, implementation; New Orleans, LA, USA (13 Sep 1983).

A residential energy forecasting model developed for the Electric Power Research Institute (EPRI) by Cambridge Systematics, Inc. is described. The model integrates the major features of two distinct approaches to energy forecasting: the engineering or end-use technique and the econometric technique. Appliance investment and usage decisions are related to price and income variables in a manner consistent with the economic theory of consumer choice, and the exact structures of these relationships are estimated econometrically from individual household survey data. The resulting system is a powerful tool that can be applied to forecast the effects of various energy policies and changing demographic and economic patterns.

49984 (EPRI-EA—3530, pp 9.1-9.33) **Measuring the impact of residential conservation programs: a case study.** O'Keefe, J.C. (Arthur D. Little, Inc., San Francisco, CA). May 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920380. (CONF-830982—).

From National conference on utility conservation programs: planning, analysis, implementation; New Orleans, LA, USA (13 Sep 1983).

The work that has been underway for the Electric Power Research Institute to develop a means to estimate the true saving resulting from residential conservation programs is discussed. In an early phase of the study, a nation-wide survey of utility-sponsored residential conservation programs was conducted. As part of this

survey the author finds that few, if any, utilities have employed appropriate methods to assess the impact of conservation programs. Furthermore, it was discovered that only one of the surveyed utilities had developed an adequate data base for such an analysis. Second, the author describes the approach developed under this research and demonstrates its application with data obtained for Portland General Electric Company's (PGE) Zero Interest Weatherization Program. The form of the analysis is based on the application of discrete choice modeling and conditional demand analysis. Finally, the author concludes by illustrating, with the use of the PGE data, how this approach is employed to estimate the proportion of a population that may participate in a particular conservation program and/or conservation action, and how the approach can be used to estimate the true or actual savings attributable to a program.

49985 (EPRI-EA—3530, pp 14.1-14.13) **Don't pay for insulation: buy conservation.** Reeves, G. May 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920380. (CONF-830982—).

From National conference on utility conservation programs: planning, analysis, implementation; New Orleans, LA, USA (13 Sep 1983).

Securing a measurable reduction in residential energy consumption has always been a major problem in evaluating conservation programs. The Residential Energy Action Program (RECAP) of the General Public Utilities System is discussed. The RECAP consists of the following elements: the utility contracts with an energy conservation company (ECCO) to provide conservation retrofits to a specified number of the utility's customers; the ECCO provides free conservation retrofits to homes; no upfront payments by utility to the ECCO; the ECCO is paid for measured savings by the utility; and the payments are made and savings monitored over a period of several years to insure that the ECCO has a continuing interest in the conservation efforts for the home. The benefits and cost of RECAP are discussed along with the allocation of risks.

49986 (EPRI-EA—3530, pp 15.1-15.13) **Utility financing of energy management: the Puget Sound Power and Light experience.** Lehenbauer, G.W. (Puget Sound Power and Light Co., Bellevue, WA). May 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920380. (CONF-830982—).

From National conference on utility conservation programs: planning, analysis, implementation; New Orleans, LA, USA (13 Sep 1983).

Puget Sound Power and Light Company of Bellevue, Washington, has been implementing residential and commercial energy management programs that provide both information and incentives. The programs offer two methods for financing cost-effective electrical energy saving improvements for facilities, the first of which is a 70% cash grant. The second is a no-interest, 10-year deferred payment loan, with early repayment incentives. Puget's residential program energy auditors perform an audit and provide the customer with estimated costs and savings at the customer's home. The auditors input data through the customer's telephone to a computer, which then reads back the results. The program includes financing of insulation, double glass and heat pumps. To date, over 23,000 loans and grants have been issued. The company's commercial energy management engineers perform audits and detailed analyses of facilities. After identifying potential energy savings, the engineer prepares the necessary design criteria and assists the customer in obtaining bids for construction. Improvement measures for commercial buildings may go beyond weatherization items, such as insulation and double glazing. The engineering analysis includes consideration of additional or improved controls for heating and cooling equipment, and even modifications to this equipment. To date, projected energy savings as a result of all these conservation programs will result in energy savings equivalent to the consumption of 21,000 average Puget Power residential customers.

49987 (EPRI-EA—3530, pp 17.1-17.18) **Home energy rating system.** Roll, J.B.; Haynie, W.R. (Peter Merrill Associates, Inc., Boston, MA). May 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920380. (CONF-830982—).

From National conference on utility conservation programs: planning, analysis, implementation; New Orleans, LA, USA (13 Sep 1983).

The Home Energy Rating System (HERS) concept is described in general terms. The Federal Home Loan Mortgage Corporation perspective is presented, relating their interest in encouraging the improvement in the housing stock with regard to energy efficiency. A brief telephone survey was conducted to ascertain the current usage of a HERS. Results are presented. The Massachusetts Pilot HERS is reviewed. Specifically, the perception of key groups regarding the HERS is summarized. Finally, several considerations are listed and discussed for a utility wishing to implement its own HERS program.

49988 (EPRI-EA—3530, pp 18.1-18.17) **Responding to the conservation needs of low-income and multi-family residential customers.** Kemper, R.C. (San Diego Gas and Electric Co., CA). May 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920380. (CONF-830982—).

From National conference on utility conservation programs: planning, analysis, implementation; New Orleans, LA, USA (13 Sep 1983).

On December 31, 1981, San Diego Gas and Electric (SDG and E) was ordered by the California Public Utilities Commission (CPUC) to design and implement two unprecedented, aggressive weatherization programs. This CPUC mandate, Decision 93892, authorized funds to weatherize the homes of 4000 low-income customers and 10,500 multi-family units annually. In response, SDG and E developed the Direct Weatherization Assistance (DWA) Program to provide free weatherization services to poor and elderly customers and the Multi-Family Weatherization (MFW) Program to subsidize the weatherization of multi-unit housing. Thw DWA program utilized two local Community-Based Organizations (CBO's) and independent licensed contractors for outreach and weatherization services; whereas the MFW program relies solely on the sales efforts of licensed contractors promoting SDG and E's 50% rebate. Reviewing the previous efforts of other utilities in early 1982, SDG and E learned that little hardware-oriented conservation services had been provided to either of these markets. Adding urgency to SDG and E's task was a CPUC threatened rate of return adjustment for non-achievement of these aggressive goals. These distinctive target markets required differing strategies. These two successful programs and their respective design and implementation strategies are addressed.

49989 (EPRI-EA—3530, pp 19.1-19.8) **Hood River Conservation Project.** Oliver, T.; Peters, D.; Peach, H.G. (Bonneville Power Administration, Portland, OR). May 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920380. (CONF-830982—).

From National conference on utility conservation programs: planning, analysis, implementation; New Orleans, LA, USA (13 Sep 1983).

The Hood River Conservation Project is a major 3 1/2 year research effort, funded by the Bonneville Power Administration (BPA), which will attempt to weatherize all electrically heated homes in the study area within a 24-month period. The Project evolved out of needs identified after the passage of the Pacific Northwest Electric Power Planning and Conservation Act (Regional Act). Under this legislation the Northwest Power Planning Council (Regional Council) was created and directed to prepare a plan defining how the region's long-term power needs will be met. This directive brings to the forefront an ongoing debate between traditional utility planning forces and organizations such as the National Resource Defense Council concerning the relative potential and thus importance of conservation to the region's energy future. The Act specifies that the Regional Council must first develop conservation, renewable, and co-generating resources to the maximum extent feasible before turning to conventional forms of power generation. Unfortunately, there is much about the potential of conservation that is unknown or is based on supposition and limited experience. The Hood River study is designed to answer questions concerning conservation program market penetration potential and the resultant impact on load shape in an effort to create a reliable regional energy plan. The Project has been developed by a wide

spectrum of agencies and organizations. Those most actively involved in planning included the Regional Council, Bonneville Power Administration, Pacific Northwest Utilities Conference Committee, Natural Resources Defense Council, Northwest Public Power Association, Hood River Electric Cooperative, and Pacific Power and Light Company.

49990 (EPRI-EA—3530, pp 20.1-20.7) **Operation wrap-up/seal-up; an inside look.** Roth, B.L. (Northeast Utilities, Hartford, CT). May 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920380. (CONF-830982—).

From National conference on utility conservation programs: planning, analysis, implementation; New Orleans, LA, USA (13 Sep 1983).

The Wrap Up/Seal Up program for Northeast Utilities is described. The program was originated by the utility to assist low-income customers in adding thermal insulation to water heaters and weatherizing their homes. It is estimated that the program saves over 100,000 barrels of oil equivalent each year. Over 85,000 customers have been serviced by the program.

49991 (EPRI-EA—3530, pp 22.1-22.21) **Can a simple physically-based model provide accurate scorekeeping of electricity savings in houses?.** Fels, M.F.; Socolow, R.H.; Stram, D.O.; Rachlin, J.N. (Princeton Univ., NJ). May 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920380. (CONF-830982—).

From National conference on utility conservation programs: planning, analysis, implementation; New Orleans, LA, USA (13 Sep 1983).

As the first phase in developing a methodology for monitoring conservation in residential electricity use, a modeling procedure, which extracts the temperature-dependent components of consumption, is tested on a New Jersey utility data base. Samples of houses with or without electric heating, with or without electric cooling, and with or without heat pump systems are selected, in order to assess the performance of the appropriate model(s) for each heating-cooling combination. The results indicate that the heating model applied to electrically heated houses without cooling performs as well as it has previously for gas-heated and oil-heated houses. The heating-plus-cooling model works well on houses with relatively strong cooling, while houses with erratic or weak cooling require an alternative approach. Although some systematic distortion of individual parameters may occur for heat-pump houses, the models appear to fit the consumption data as well for houses with heat-pump systems as they do for resistively heated houses. As a preliminary application to scorekeeping, the methodology is applied to two conservation test cases. The significance of the implied savings is carefully evaluated. Overall, the normalized annual consumption index, from which total savings are calculated, appears to be highly reliable.

49992 (EPRI-EA—3530, pp 7.1-7.21) **Impact and cost-effectiveness of utility conservation programs: the Hartford Foundation project.** Norland, D.L. (Alliance to Save Energy, Washington, DC). May 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920380. (CONF-830982—).

From National conference on utility conservation programs: planning, analysis, implementation; New Orleans, LA, USA (13 Sep 1983).

The engineering and economic results of the study for the 20 commercial and industrial Standard Industrial Classification (SIC) categories examined are presented. Audits of AP and L's largest commercial and industrial customers were performed to identify generic conservation devices, construct facility models, and evaluate kWh and kW savings potential. Paybacks were calculated and used in a market penetration model to project adoption rates for each device by SIC category. The projected market penetration curves were then recalculated, assuming two levels of cash rebates offered by the utility. The paper concludes with a cost/benefit evaluation of the alternative conservation programs.

49993 (EPRI-EA—3530, pp 21.1-21.15) **Determinants of interest in new energy reduction projects among commercial and industrial ratepayers.** Feldman, S. (Arbor, Inc., Philadelphia, PA). May 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920380. (CONF-830982—).

From National conference on utility conservation programs: planning, analysis, implementation; New Orleans, LA, USA (13 Sep 1983).

Intentions to engage in energy reduction projects were determined for 402 commercial and industrial ratepayers in a 20-minute telephone survey, along with responses to a variety of attitudinal and motivational questions and descriptions of business and building characteristics. Four ratepayer segments were defined on the basis of background characteristics. These segments are most conveniently defined in terms of whether the major activity of the account is office work or classes, manufacturing, services, or sales. Statistical analysis also identified three major classes of respondent motives for engaging in the energy reduction projects -- cost salience of energy, uncertainty of energy supplies and availability of new ideas on energy consertion, and four major classes of perceived barriers -- lack of incentive for conservation, internal management disinterest, competing financial needs and lack of information on conservation techniques. Additional analysis indicated that intentions to engage in energy reduction projects are significantly related to the motives and perceived barriers identified and to other attitudinal factors. Furthermore, the factors that seem to condition intentions to engage in energy reduction projects differ significantly in their impact among the different segments. Competing financial needs are a particularly salient financial barrier for members of the office work or classes segment, but seem to be a stimulus to action for members of the sales segment. Some implications of these findings for the design and marketing of utility conservation programs are explored.

49994 **(LBL—17364) Comparisons of predicted and measured energy use in occupied buildings.** Wagner, B.S. (Lawrence Berkeley Lab., CA (USA)). May 1984. Contract AC03-76SF00098. 26p. (CONF-840651—3; EEB-BED—84-02). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85000700.

From ASHRAE semi-annual conference; Kansas City, MO, USA (24 Jun 1984).

During the past decade, a number of studies have reported comparisons of building energy simulations to measured building performance. Over two dozen studies, comprising about 100 simulations of building energy use, have been compiled and categorized by quality of input and energy consumption data, type of study, model used, quality of input and consumption data, expertise of input preparer, and control and monitoring of occupancy. This paper summarizes results of studies of occupied buildings in which monitoring varied from very detailed to nonexistent, the comparison interval from hourly to yearly, and the number of buildings from one to 200-plus. These results are briefly compared to results from unoccupied buildings and preliminary conclusions are presented about the use of building energy models for different types of field applications. This is an ongoing compilation to which contributions both of data and methodological suggestions are invited.

49995 **(LBL—17967) Lighting controls: the role of advanced technology - past, present, and future.** Verderber, R.R.; Rubinstein, F.M. (Lawrence Berkeley Lab., CA (USA)). May 1984. Contract AC03-76SF00098. 17p. (CONF-8406200—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE84015977.

From National Research Council of Canada's lighting control symposium; Ottawa, Canada (28 Jun 1984).

The role of technology in the development of lighting control systems is examined. Prior to 1973, control systems were primarily functional. They were used to switch lamps on and off, or to create a mood. Nearly all dimming was done with incandescent lamps. Since 1973, the rising cost of electrical energy has made the operational cost of systems a design factor. Lighting controls are used to decrease power, reduce the time of use, and lower peak power demands. New lighting control equipment is based on existing technologies that have been modified to meet the needs of light-

ing systems. The technologies came primarily from the field of electronics.

49996 **(LBL—17994) Energy conservation in public housing: the San Francisco experience.** Goldman, C.; Ritschard, R.; Atkielski, R. (Lawrence Berkeley Lab., CA (USA); San Francisco Housing Authority, CA (USA)). Jun 1984. Contract AC03-76SF00098. 17p. (CONF-840819—12; EEB-BED—84-03). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000319.

From Doing better: setting an agenda for the second decade; Santa Cruz, CA, USA (14 Aug 1984).

In 1982, the San Francisco Housing Authority began installing specified energy conservation measures financed under a zero interest loan program (ZIP) from the local utility company. The retrofit measures included attic insulation, exterior door weatherstripping, low-flow showerheads, and water heater blankets. By the end of 1983, 4082 apartments (59% of the authority's units) had been weatherized at a cost of approximately $396,000. Three years of metered gas consumption data are analyzed including one year of post-retrofit data, for five family housing projects (totalling 1980 units) in an attempt to determine energy savings attributable to the retrofits. Post-retrofit energy consumption levels are 7 to 20% lower in the four projects that saved energy. Analysis of model parameter estimates indicates that the energy savings are due to reduced baseload use. This result suggests that measures designed to reduce hot water consumption were particularly effective. In the fifth project, annual energy use increased by 14%. Overall, the Housing Authority's recent retrofit efforts in the five projects are cost-effective, with an average simple payback of 4.6 years and a cost of conserved energy of $2.50/MBtu. The Housing Authority's efforts to retain tight budgetary control over retrofit costs, which averaged only $150/unit, contributed to the program's success. The study also examines the applicability of a building energy analysis model to multi-family building located in mild climates. We find that it is important to account explicitly for changes in vacancy rates in analyzing consumption patterns, particularly when evaluating the impact of retrofits in multi-family buildings with high turnover and fluctuating occupancy rates.

49997 **(LBL—18114) New lighting technologies, their status and impacts on power densities.** Verderber, R.R.; Rubinstein, F.M. (Lawrence Berkeley Lab., CA (USA)). Jul 1984. Contract AC03-76SF00098. 11p. (CONF-840819—13; EEB-L—84-10). NTIS, PC A02/MF A01; GPO Dep. File Number DE85000712.

From Doing better: setting an agenda for the second decade; Santa Cruz, CA, USA (14 Aug 1984).

There have been many new lighting products introduced since the 1973 energy crises. The products that entered the market most rapidly were based on existing technologies and relied primarily on reducing light levels to reduce electrical power use. These systems worked for retrofitting existing spaces that were over-illuminated. In the mid-70s, new products employing new technologies were developed that increased the efficacy of producing and distributing visible light. These included the high-frequency operation of fluorescent lamps, replacement of incandescent light sources, and effective management of lighting. These technologies will be described and their present status, with regard to their current use, will be discussed. Their impacts on energy use and on the quantity and quality of illumination will be presented. The results will provide evidence that proposed lighting power densities of 1.5 watts per square foot for lighting can be realized.

49998 **(NHA—5492-82/09) Energy efficiency in multi-unit residential buildings: a handbook for owners and operators.** (Canada Mortgage and Housing Corp., Ottawa, Ontario). 1982. 92p. Canada Mortgage and Housing Corp., Ottawa, Ontario $6.00. File Number TI84900991.

The handbook is divided into three chapters. The first briefly defines energy efficiency in the context of multi-unit residential building management, sets out standards to aim for, and describes the essential elements of an energy conservation program. This section will be of particular interest to owners. Chapters 2 and 3 are intended primarily for use by operators. They present practical guidelines and instructions for the operation and maintenance of various types of equipment. Four appendices provide detailed examples and checklists that will help users apply the methods described.

49999 **(NP—4770474) High temperature absorption heat pump.** Girsberger, W. (Eidgenoessische Technische Hochschule, Zurich (Switzerland)). Jan 1981. 199p. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number DE84770474.

The directly fired absorption heat-pump is an efficient tool to conserve high-quality fuels for heating purposes. The heat ratio can be considerably raised beyond the values realized today when the driving heat input is added at higher temperatures. Preconditions for this purpose are an expedient multistage circuit and suitable working fluids with standing high temperature conditions. A fundamental research of all principal possibilities leads to a new systematology of multi-stage sorption heat pump processes. Moreover, a list of requirements for the working fluids was set up. Solubility and stability impose the most restricting conditions. Corrosion, crystallization, toxicity exclude all inorganic mixtures. Aromatics and highly fluorinated molecules are the only organic substances exhibiting sufficient thermal stability. To obtain the desired high solubilities, H-bonding is necessary. These conditions are satisfied most nearly by fluorinated alcohols in aromatic N-heterocycles. In an equilibrium apparatus, solubilities were measured between 100°C and 200°C. Fluoralcohols and quinoline are the most promising high temperature working fluids.

50000 **(NP—4901771) Conserving energy in Ohio glass greenhouses. Final report, March 1, 1978-December 31, 1980.** Bauerle, W.L.; Short, T.H. (Ohio Agricultural Research and Development Center, Wooster (USA)). Jan 1981. 10p. Dept. of Development, Div. of Energy, PO Box 1001, Columbus, OH 43216. File Number TI84901771.

The advantages of applying double plastic over glass in commercial greenhouses are reviewed. Supplementing with carbon dioxide is discussed. The project activities are reviewed as follows: handbooks and newsletters, demonstration sites and experimental designs, alternate conservation methods, meetings and workshops, and publications from the project. (MHR)

50001 **(NP—4901786) Life-cycle cost analysis project. Final report.** Davies, G.R.; Temming, S.J. (Cincinnati Univ., OH (USA). Dept. of Mechanical and Industrial Engineering). 30 Sep 1980. 206p. Dept. of Development, Div. of Energy, P.O. Box 1001, Columbus, OH 43216. File Number TI84901786.

An investigation was conducted to demonstrate the impact of life-cycle costing in Ohio's residential building sector. Typical single-family, townhouse, and multifamily housing units were modeled using sophisticated computer programs to predict annual energy comsumption. Energy conservation techniques were applied to the typical units and the resulting utility savings were computed. Installed costs were estimated for each energy conservation technique.

50002 **(NP—4901788) Remote sensing survey of energy losses from public buildings. Final report.** Mintzer, O.; Kulacki, F.A.; Perez-Rodriquez, J.; Greenberger, S.; LaRue, R.D. (Ohio Dept. of Energy, Columbus (USA)). Aug 1980. 210p. Dept. of Development, Div. of Energy, P.O. Box 1001, Columbus, OH 43216. File Number TI84901788.

It is the objective of this study to develop and demonstrate that thermography can be used to measure roof top heat losses from commercial and industrial buildings. Up to now, most thermography studies have been qualitative interpretations of building temperatures and identifications of excess heat lost, that is, hot spots. Thermal imaging of building surfaces is a useful qualitative tool and as shown herein, under certain calibrated conditions, may also be a quantitative tool in assessing energy losses from building envelopes. In most cases, the limitation of the utility of the thermal image arises not because the image is of poor quality, but because of the difficulty in correctly interpreting and analyzing the image. A method of calibrating thermography data is given. Several methods of presenting the data visually are also given: constant temperature contours, digital, color, gray tone and three-dimensional representa-

tion. A thermally calibrated reference area within a flat-roof surface eliminates much of the uncertainty in measuring surface temperature and provides for a measure of heat flux that is bounded by quantifiable errors. The major sources of inaccuracy and imprecision are surface material emissivity and the local environmental conditions, i.e., wind speed, cloud cover, and sky temperature.

50003 **(NZERDC-P—74) Computing building heat loads. A comparative survey of four heat load determination programmes. Final report.** Ang, S.T.; Stephenson, J. (Auckland Univ. (New Zealand). Dept. of Mechanical Engineering; New Zealand Energy Research and Development Committee, Auckland). May 1983. 67p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85900108.

Four computer programs used for calculating building heat loads have been investigated in this report. Due to different approaches adopted in the formulation of these programs some variations in their outputs (based on similar inputs) were expected and these have been observed. The report first discusses what constitutes a good heat load program and then presents a survey of some computer oriented heat load determination methods. Subsequently the theoretical basis of each program is given. The basic difference between the programs is that two of them (NBSLD, TEMPER) perform calculations based on real environmental data, while the remaining two (TEMPER, HEAT-GAINS) use artificially simulated environmental information. Comparison runs have been made on the same building. The loads were compared for cases without external shading, with vertical and with horizontal shading.

50004 **(NZERDC-P—76) Model of commercial energy use in Greater Auckland.** Saha, G.P. (New Zealand Energy Research and Development Committee, Auckland). May 1983. 200p. NTIS (US Sales Only), PC A09/MF A01. File Number DE85900111.

This study deals with a detailed engineering-economic model which was developed to simulate energy use in the commercial offices subsector of Greater Auckland area from 1980 to 2000. The model is sensitive to major architectural, engineering and economic determinants; it provides information on energy use by fuel type (electricity, gas and oil) and end uses (space heating, space cooling, lighting, fan energy and other). The model consists of a central simulation model and six submodels. These are: floor space construction model, natural lighting simulation model, heating and cooling load and lighting energy model, air-conditioning system simulation model, fuel-split model, and utilization rate model. An econometric model based on major determinants was developed to forecast new floor space construction for each year. The natural lighting simulation model establishes for representative present-day and future buildings the hours of the day when artificial lighting would be required. The heating and cooling load model calculates for representative present-day and future buildings hour-by-hour heating and cooling loads for the twelve months. These values form the input to the air-conditioning system energy required to meet the hour-by-hour loads. The fuel-split model estimates the market-share of major fuels for various end uses, and the utilization-rate model estimates changes in the intensity of use of the major fuels for various end uses. The central simulation model combines outputs from each of the sub-models with appropriate boundary conditions for the years 1980 to 2000. Outputs from the simulation model include fuel use components for three fuels and five end uses for each year of the simulation.

50005 **(ORNL/Sub—80-7948/1) Southwest Thermal Mass Study, Tesuque Pueblo, New Mexico: the effect of envelope thermal mass on the heating energy use of eight test buildings in a high desert climate (September 1981-December 1982).** Gustinis, J.; Robertson, D.K. (New Mexico Univ., Albuquerque (USA). New Mexico Energy Research and Development Inst.). Apr 1984. Contract AC05-84OR21400. 115p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85001735.

Eight windowless one-room test buildings, 6.10 m square and 2.29 m high inside, were constructed on a high desert site near Tesuque Pueblo, New Mexico, to study the influence of wall dynamic heat transfer characteristics on building heating energy requirements (such influence is sometimes called the thermal mass effect). The buildings are nominally identical except for the walls, and are instrumented to record building component temperatures and heat fluxes; indoor temperature, humidity, globe temperature, and interior surface temperatures; and outdoor weather, solar data, and ground temperatures. This report presents the results from analysis of heating season data for one year. A simple method of analysis using steady-state methods on time-averaged data is derived from first principles. Energy use data for each building are correlated to weather parameters and building interior conditions, and are compared to predictions of steady-state modeling. Comfort parameters are evaluated for each building, and critically compared. In situ measurements of wall thermal properties and dynamic heat transfer characteristics are presented, including data for adobe walls.

50006 **(ORNL/Sub—81-22201/2) Correlations of solar irradiance and daylight illuminance for building energy analysis.** Gillette, G.; Treado, S. (National Bureau of Standards, Washington, DC (USA)). Oct 1984. Contract AC05-84OR21400. 35p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85001736.

The concept of luminous efficacy, the ratio of daylight illuminance to solar irradiance, is investigated for use in building energy analyses. Horizontal and vertical luminous efficacies are evaluated as functions of solar altitude, cloud condition, atmospheric extinction coefficient, turbidity, and season. Based on sky measurements made at the National Bureau of Standards, values of luminous efficacy for total, diffuse, and direct beam radiation are presented.

50007 **(PB—84-205376) Uplighting design guide.** Boyce, P.R. (Electricity Council Research Centre, Capenhurst (UK)). Apr 1984. 51p. (ECRC/M—1784). NTIS, PC E05/MF E05.

This Memorandum is concerned with the use of uplighting in offices. Its aims are to help the reader to identify situations where uplighting is an appropriate technique and to design an uplighting installation suitable for the application. An uplighting installation is one in which nearly all the light from the lamps reaches the working surfaces after reflection from the ceiling. Uplighters can be free standing, mounted on furniture or walls, or suspended from the ceiling. Regardless of the type of uplighter, diffuse lighting free from strong shadows and veiling reflections will be produced. This makes uplighting particularly appropriate for such applications as drawing offices, and offices where visual display units are widely used.

50008 **(PB—84-207307) Conserving energy in your home.** de Colon, I.A. (Puerto Rico Univ., Mayaguez). Mar 1983. 45p. (In Spanish). NTIS, PC A03/MF A01.

Errata sheet inserted.

This pamphlet provides a list of practical and cost free steps you can take to conserve energy. Appendices explain how to select, buy and, use household appliances and equipment; and how to prepare a monthly budget for the consumption of electricity.

50009 **(PB—84-210558) Report on the energy management installation at 1765 Weston Road.** (Ontario Ministry of Municipal Affairs and Housing, Toronto (Canada)). Aug 1983. 63p. NTIS, PC E04/MF E01.

Sponsored in part by Ontario Ministry of Energy, Toronto. Prepared in cooperation with Adaptive Microelectronics Ltd., Toronto (Ontario).

In September 1981 an experimental computerized energy management system for control of space heating, ventilation, and domestic hot water was installed in a highrise gas-heated apartment building. The project was undertaken jointly by the Ontario Ministries of Municipal Affairs and Housing and Energy under the Housing Energy Management Program (H.E.M.P.). Two architecturally identical buildings owned by Meridian Property Management (308182 Ontario Limited) were selected for the experiment; 1765 Weston Road as the demonstration building and 1775 Weston Road as the control. Equipment was installed in each building to monitor space heating and domestic hot water temperatures, corridor supply and building exhaust air temperatures. York Hydro and Consumers

Gas installed pulse generating equipment in the metering systems of each building to allow remote monitoring of hydro and gas consumption by ADMIC equipment. At 1765 Weston Road the space heating water and intake air temperature set points and fan operation were put under the control of ADMIC Controls' Central Station computer.

50010 **(PB—84-210566) Improved efficiency domestic hot water tank field study - installation report - report No. 8A.** (Ontario Ministry of Municipal Affairs and Housing, Toronto (Canada)). Jan 1984. 28p. NTIS, PC E04/MF E01.

Sponsored in part by Ontario Ministry of Energy, Toronto. Prepared in cooperation with Union Gas Limited, Toronto (Ontario).

In June 1983, the Ontario Ministry of Municipal Affairs and Housing entered into discussion with Union Gas Limited concerning the possibility of a joint research project to study high efficiency heating equipment. As a result of these talks, an agreement to field test two improved efficiency water heaters was reached. Each unit is monitored relative to a conventional unit of comparable capacity at the same site. Having completed the installation and commissioning of two such water heaters, this report addresses the details of the installations and the findings to date. Both water heaters are currently operating and are being monitored. Test results are expected upon completion of one year of operation.

50011 **(PB—84-210574) Energy conservation building operations demonstration for forty high-, medium- and low-rise multiple-unit residential buildings.** (Ontario Ministry of Municipal Affairs and Housing, Toronto (Canada)). Jan 1984. 95p. NTIS, PC E05/MF E01.

Sponsored in part by Ontario Ministry of Energy, Toronto. Prepared in cooperation with Engineering Interface Ltd., Toronto (Ontario).

In October 1981, groups of apartment building owners and managers attended a briefing session to learn about an upcoming energy management demonstration project. The purpose of the project was to gauge the effectiveness of instructional workshops in conjunction with an audit of previous years' energy use and monitoring of ongoing energy use.

50012 **(PB—84-210590) High efficiency residential condensing gas forced air and high efficiency pulse boilers field evaluation - final report (project report No. 5B).** (Ontario Ministry of Municipal Affairs and Housing, Toronto (Canada)). Feb 1984. 35p. NTIS, PC E04/MF E01.

Sponsored in part by Ontario Ministry of Energy, Toronto. Prepared in cooperation with Northern and Central Gas Corp. Ltd., Toronto (Ontario).

The field evaluation of these installations were carried out from January, 1982 through to the May, 1983 heating season to generate the performance and operation data. This report contains information on the results of the test site data and its comparison to existing equipment which promotes energy conservation.

50013 **(PB—84-210608) Medium efficiency non-condensing furnace field study - installation report - report No. 9A.** (Ontario Ministry of Municipal Affairs and Housing, Toronto (Canada)). Jan 1984. 27p. NTIS, PC E03/MF E01.

Sponsored in part by Ontario Ministry of Energy, Toronto. Prepared in cooperation with Union Gas Limited, Toronto (Ontario).

In June 1983, the Ontario Ministry of Municipal Affairs and Housing entered into discussion with Union Gas Limited concerning the possibility of a joint research project to study high efficiency heating equipment. As a result of these talks, and funding from Ministry of Energy, an agreement to field test several high efficiency non-condensing furnaces was reached. Having completed the installation and commissioning of one such furnace, this report addresses the details of the installation and commissioning of the unit. The furnace is currently operating and is being monitored. Test results are expected upon completion of the '83/'84 heating season.

50014 **(PB—84-210772) High efficiency condensing furnace field study, final report (project report No. 3B).** (Ontario Ministry of Municipal Affairs and Housing, Toronto (Canada)). Oct 1983. 26p. NTIS, PC E04/MF E01.

Sponsored in part by Ontario Ministry of Energy, Toronto. Prepared in cooperation with Union Gas Limited, Toronto (Ontario).

Under contract with the Ontario Ministry of Municipal Affairs and Housing, Union Gas Ltd. has undertaken to field test two condensing gas furnaces. With the units installed, Union Gas has monitored their performance in an effort to gain operating results. The purpose then of this report is to summarize the results as collected this past heating season (82/83), and to evaluate the energy savings potential of the equipment itself.

50015 **(PB—84-212091) History and description of the EPA (Environmental Protection Agency) motor vehicle fuel economy program. Technical report.** Tyree, C.D. (Environmental Protection Agency, Ann Arbor, MI (USA)). Sep 1982. 16p. NTIS, PC A02/MF A01.

This report describes the history of the Environmental Protection Agency's (EPA) fuel economy program from the early 1970's up to and including the 1984 model year. (Beginning with the 1985 model year program significant changes were made to the program to improve the accuracy of the label values. These changes are not addressed in this document.) The fuel economy program is conducted at the Motor Vehicle Emission Laboratory (MVEL) located in Ann Arbor, Michigan. The energy crisis of the early 1970's brought into focus the need for a reliable source of automobile fuel economy information. Because the EPA was already testing representative vehicles from all manufacturers for exhaust emissions compliance the task of generating fuel economy values on these vehicles was straight forward. Congress gave EPA the responsibility for establishing a mandatory fuel economy program beginning with the 1977 model year. This report describes the methodology used to group a manufacturer's product line into representative subgroups for testing and calculation purposes. The resulting data are used to calculate new car label values, each individual manufacturer's Corporate Average Fuel Economy (CAFE), and any potential Gas Guzzler Tax liability.

50016 **(PB—84-212455) Estimate of changes to fuel economy label values resulting from the proposed mid-year label updating. Technical report.** (Environmental Protection Agency, Ann Arbor, MI (USA)). Nov 1982. 8p. NTIS, PC A02/MF A01.

The Environmental Protection Agency (EPA) is proposing several changes to the current fuel economy program which will increase the usefulness and representativeness of the fuel economy values to consumers. One of these proposals is to have the label values updated at least once per model year, at about mid-year. The label updating would involve recalculating the label values using revised sales projections and including test data obtained since the initial label calculation. This report estimates the maximum number of label values that would likely change by mid-year and magnitude these changes.

50017 **(PB—84-212471) Cost analysis of proposed changes to 40 CFR (Code of Federal Regulations) Part 600 to improve fuel economy labeling and the fuel economy data base. Technical report.** Tyree, C.D. (Environmental Protection Agency, Ann Arbor, MI (USA)). Sep 1982. 14p. NTIS, PC A02/MF A01.

This analysis has been written to estimate the economic impact on the automotive industry of the various rule changes proposed in the Notice of Proposed Rulemaking (NPRM) entitled 40 Code of Federal Regulations Part 600 Fuel Economy of Motor Vehicles-Revisions to Improve Fuel Economy Labeling and Fuel Economy Data Base.

50018 **(PB—84-215110) Main characteristics of low-cost housing aimed at reducing energy consumption for heating. Final report.** Heikhaus, H.H.; Lebrun, J.; Laret, L. (Commission of the European Communities, Luxembourg). 1983. 285p. (In French). (EUR—8370-EN/FR). NTIS, PC E12/MF E12.

Summary report in English.

The results here presented are those of the third and last two-year period of research program initially devoted to the 'real

fuel consumption for the heating of houses'. The starting point of this research has consisted in evaluating the real effect of different energy saving measures (mainly improvements of the envelope) in existing but unoccupied houses. In order to overcome the numerous uncertainties that occur in the monitoring of real houses, an 'intermediate step' of experimental analysis has been introduced into the second research period: it consists in measuring the 'floating' temperature and heating energy consumption of a dozen of very simplified (and therefore physically well-defined) reduced scale models. This new experimental tool has been used parallelly with other attempts of measurements and calculations on real houses and with the development of the theoretical methods.

50019 **(PNL—5143-Vol.1) Weather data for simplified energy calculation methods. Volume I. Eastern United States: TRY data.** Olsen, A.R.; Moreno, S.; Deringer, J.; Watson, C.R. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1984. Contract AC06-76RL01830. 265p. NTIS, PC A12/MF A01; 1; GPO Dep. File Number DE85000493.

The objective of this report is to provide a source of weather data for direct use with a number of simplified energy calculation methods available today. Complete weather data for a number of cities in the United States are provided for use in the following methods: degree hour, modified degree hour, bin, modified bin, and variable degree day. This report contains sets of weather data for 23 cities in the continental United States using Test Reference Year (TRY) source weather data. The weather data at each city has been summarized in a number of ways to provide differing levels of detail necessary for alternative simplified energy calculation methods. Weather variables summarized include dry bulb and wet bulb temperature, percent relative humidity, humidity ratio, wind speed, percent possible sunshine, percent diffuse solar radiation, total solar radiation on horizontal and vertical surfaces, and solar heat gain through standard DSA glass. Monthly and annual summaries, in some cases by time of day, are available. These summaries are produced in a series of nine computer generated tables.

50020 **(PNL—5143-Vol.2) Weather data for simplified energy calculation methods. Volume II. Middle United States: TRY data.** Olsen, A.R.; Moreno, S.; Deringer, J.; Watson, C.R. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1984. Contract AC06-76RL01830. 255p. NTIS, PC A12/MF A01; 1; GPO Dep. File Number DE85000494.

The objective of this report is to provide a source of weather data for direct use with a number of simplified energy calculation methods available today. Complete weather data for a number of cities in the United States are provided for use in the following methods: degree hour, modified degree hour, bin, modified bin, and variable degree day. This report contains sets of weather data for 22 cities in the continental United States using Test Reference Year (TRY) source weather data. The weather data at each city has been summarized in a number of ways to provide differing levels of detail necessary for alternative simplified energy calculation methods. Weather variables summarized include dry bulb and wet bulb temperature, percent relative humidity, humidity ratio, wind speed, percent possible sunshine, percent diffuse solar radiation, total solar radiation on horizontal and vertical surfaces, and solar heat gain through standard DSA glass. Monthly and annual summaries, in some cases by time of day, are available. These summaries are produced in a series of nine computer generated tables.

50021 **(PNL—5143-Vol.3) Weather data for simplified energy calculation methods. Volume III. Western United States: TRY data.** Olsen, A.R.; Moreno, S.; Deringer, J.; Watson, C.R. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1984. Contract AC06-76RL01830. 273p. NTIS, PC A12/MF A01; 1; GPO Dep. File Number DE85000495.

The objective is to provide a source of weather data for direct use with a number of simplified energy calculation methods available today. Complete weather data for a number of cities in the United States are provided for use in the following methods: degree hour, modified degree hour, bin, modified bin, and variable degree day. This report contains sets of weather data for 24 cities in the continental United States using Test Reference Year (TRY) source weather data. The weather data at each city has been summarized in a number of ways to provide differing levels of detail necessary for alternative simplified energy calculation methods. Weather variables summarized include dry bulb and wet bulb temperature, percent relative humidity, humidity ratio, wind speed, percent possible sunshine, percent diffuse solar radiation, total solar radiation on horizontal and vertical surfaces, and solar heat gain through standard DSA glass. Monthly and annual summaries, in some cases by time of day, are available. These summaries are produced in a series of nine computer generated tables.

50022 **(PNL—5143-Vol.4) Weather data for simplified energy calculation methods. Volume IV. United States: WYEC data.** Olsen, A.R.; Moreno, S.; Deringer, J.; Watson, C.R. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1984. Contract AC06-76RL01830. 263p. NTIS, PC A12/MF A01; GPO Dep. File Number DE85000491.

The objective of this report is to provide a source of weather data for direct use with a number of simplified energy calculation methods available today. Complete weather data for a number of cities in the United States are provided for use in the following methods: degree hour, modified degree hour, bin, modified bin, and variable degree day. This report contains sets of weather data for 23 cities using Weather Year for Energy Calculations (WYEC) source weather data. Considerable overlap is present in cities (21) covered by both the TRY and WYEC data. The weather data at each city has been summarized in a number of ways to provide differing levels of detail necessary for alternative simplified energy calculation methods. Weather variables summarized include dry bulb and wet bulb temperature, percent relative humidity, humidity ratio, wind speed, percent possible sunshine, percent diffuse solar radiation, total solar radiation on horizontal and vertical surfaces, and solar heat gain through standard DSA glass. Monthly and annual summaries, in some cases by time of day, are available. These summaries are produced in a series of nine computer generated tables.

50023 **(VTT-TIED—253) Methods for measuring the airtightness and air change rates in buildings.** Railio, J.; Saarnio, P. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). Oct 1983. 60p. (In Finnish). Valtion Teknillinan Tutkimuskeskus, Espoo, Finland. File Number TI84751668.

In these instructions for measuring the airtightness and air change rates in buildings, the principles of measurement methodics, the need for measurements and choosing the correct method for different purposes, are presented. Details of measuring are described for the most common methods: the pressure test, the collector changer method for measuring local leakages, and the tracer gas methods. In addition, other methods and auxiliary measurements are presented.

50024 **Conservation's value varies with view.** Hirst, E. (Oak Ridge National Lab., TN). *Electrical World;* **198**: No. 7, 69-70(Jul 1984).

A great deal of money is spent on utility conservation programs. Little has been done, however, to measure program performance in a consistent manner using actual program-generated data. This article looks at the major issues that need to be addressed and uses an evaluation of a residential retrofit program in the Pacific Northwest to discuss their implications. 3 figures.

50025 **(ORNL-tr—5149) Wide-range, high-efficiency control system for the refrigeration cycle.** Yamazaki, O.; Matsuoka, H.; Iijima, H.; Saito, E. Translated from *Mitsubishi Denki Giho ;* **58**: No. 5, 1-3(1984). Contract AC05-84OR21400. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016130. DE84016130

The wide-area high-efficiency control system for the refrigeration cycle introduced here is suitable for use with a capacity-control type heat pump which utilizes an inverter. The system is designed to control all the functions of components with a microprocessor. This technology can be employed for making refrigerating units and heat pumps for water heating as well as for air conditioning. It will be widely utilized for energy saving and convenient refrigerators and air conditioners in the future.

50026 **(ORNL-tr—5150) Air heat source heat pump chiller with a new refrigerant flow rate control.** Tanaka, N.; Imanishi, M.; Hama, H. Translated from *Mitsubishi Denki Giho ;* **58**: No. 5, 21-24(1984). Contract AC05-84OR21400. 14p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016098. DE84016098

Evaluation of the new refrigerant control method suitable for using at a wide range of operating conditions and for incorporating the use of the microcomputer has proved that the method which adjusts the degree of cooling the capillary tube with a low temperature refrigerant depressurized with the pilot valve (electromagnetic expansion valve) has been proved very satisfactory. The air heat source heat pump chiller which used this control method has demonstrated a high level of performance and reliability.

50027 **Stimulating energy conservation in commercial buildings: A simulation analysis of alternative policies.** Corum, K.R.; Van Dyke, J. (Oak Ridge National Laboratory, Oak Ridge, TN). *Energy Policy;* **11**: No. 1, 52-62(Mar 1983).

Using an engineering-economic model, this paper examines three alternative policies for stimulating energy conservation in the US commercial sector. The policies were constructed so that each would result in equivalent annual levels of energy use in 2000. This formulation results in a description of the level of tax credits or fuel taxes which result in annual energy use equivalent to a given set of efficiency standards. Of the three policies examined, the tax on fuel results in the lowest cost of resources (fuel and capital) over the period. However this policy also results in reduced amenity levels over the simulation period (1980-2000) and a less efficient stock of building in place at the end of the period.

3202 Transportation

REFER ALSO TO CITATION(S) 32020049942, 50069, 50074, 50075

50028 **(CONF-8404194—1) Transportation energy use and efficiency in Tunisia.** Greene, D.L. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 35p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85001103.

From Association of American Geographers annual meeting; Washington, DC, USA (21 Apr 1984).

The results of a joint Government of Tunisia-US Agency for International Development study of energy use and efficiency in Tunisia's transport sector are summarized. A national survey of automobile and light truck energy use including over 10,000 vehicles was conducted in 1982 to 1983. Results of this survey and analysis of other data obtained from transport companies reveal that the transport sector and particularly light trucks are largely responsible for dramatic increases in distillate fuel consumption over the past decade. An example of how the detailed survey data can be used in energy conservation policy analysis is presented.

50029 **(DOE/CS/55138—T1) Considering high occupancy vehicle alternatives in the urban transportation planning process: energy savings. Final report, August 1981-October 1983.** Clifford, M.J.; Wickstrom, G.V. (Metropolitan Washington Council of Governments, DC (USA)). Oct 1983. Contract AI01-78CS55138. 83p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85000739.

Preferred treatment of high occupancy vehicles (HOV's), through strategies such as dedicated lanes, can achieve transportation energy conservation. The research presented in this report provides a method for regional planning agencies to assess such HOV facilities, from a travel demand and energy consumption standpoint. The planning process is described and applied in a case study. Products of the case study included estimates of carpool formation and associated fuel savings, and traffic operations on HOV and other facilities in the corridor. The completed process represents a method to examine HOV's under a variety of policy and operational conditions. The process is within the modeling capabilities of other Metropolitan Planning Organizations (MPO's) and should be transferable to other cities and corridors. Additional applications of the HOV estimation and evaluation process are recommended.

50030 **(DOT-I—83-32) Incorporating energy conservation into the transportation planning process: mid-sized areas.** Alberts, B.S. (Northern Middlesex Area Commission, Lowell, MA (USA)). Mar 1983. Contract AI01-78CS55138. 169p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE85000740.

This report describes the methods by which mid-size Metropolitan Planning Organizations (MPOs), between 200,000 and 750,000 in population are incorporating energy conservation concerns into their urban transportation planning process. Nine MPOs were selected for case study analysis. General conclusions were extrapolated from these case studies. The study found that the particular characteristics of these areas, such as travel patterns and spatial patterns, tend to inhibit energy conservation efforts in the transportation sector, and that some strategies which have been used in larger metropolitan areas may not apply in mid-size areas. Nevertheless, MPOs do consider energy use within their planning processes in a variety of ways: adopting of energy goals, determining the energy consumption of network alternatives, assessing energy impacts of TSM, etc. These findings suggest a number of roles for mid-size MPOs regarding energy conservation: educating the public; analyzing traffic flow improvements for their energy impacts; encouraging ridesharing alternatives; and utilizing energy consumption as one program and project assessment criterion.

50031 **(DOT-I—84-28) Incorporating energy analysis in the transportation improvement program process.** Erlbaum, N.S.; Gross, J.M.; Hartgen, D.T.; Nidetz, J.; Holthoff, W.C.; Jaschik, N.L. (New York State Dept. of Transportation, Albany (USA); Genesee Transportation Council, Rochester, NY (USA)). Jul 1984. Contract AI01-78CS55138. 159p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE85000738.

The New York State Department of Transportation, evaluated the energy impact of proposed transportation projects, described these findings to local officials, and examined the impact of this information on project selection. The results of the energy analysis of 92 projects proposed for the 1983-84 Transportation Improvement Program showed that their implementation will result in an annual user saving of 5.9 million gallons by 1990; the annualized construction energy required for these projects is 2.1 million gallons and the annual net saving is 3.8 million gallons (1.3% of 1980 gasoline consumption). The assessment of the long term changes in transportation energy use showed that improvements in vehicle efficiency will result in an annual saving of 85.7 million gallons by 1990 (29.2% of 1980 gasoline consumption) increase in consumption resulting from increases in traffic due to expect growth in the number of households. Review of the process to create GTC's 1983-1988 TIP showed that while no decisions were changed solely because of the energy impact information provided, this information enhanced the projects' acceptance. Once presented on a regular basis in the TIP process, the energy impact data may be more useful. Two additional places in the project development process where energy impact information could be useful are systems planning and design. The issue of the transferability of the findings was investigated and it was found that the results, methodologies and ideas could be employed by other places, constrained by those factors which make other cities unique or different from Rochester.

50032 **(ORNL—6066) Transportation energy use and efficiency in Tunisia.** Greene, D.L.; Hu, P.S.; Rose, A.B. (Oak Ridge National Lab., TN (USA)). Aug 1984. Contract AC05-84OR21400. 139p. NTIS, PC A07/MF A01; GPO Dep. File Number DE85000483.

This document constitutes a final report of research by Oak Ridge National Laboratory in collaboration with staff of the Ministry of National Economy, Government of Tunisia toward a complete evaluation of transportation energy use and efficiency in Tunisia. The report includes chapters on highway passenger, marine, and rail transportation which are substantially complete. Additional data on taxis, louages (intercity taxis) and privately owned large trucks remain to be gathered. Some key tables have been included. Data for an analysis of the air and pipeline modes were not collected. The major achievement of this report is a detailed analysis of the National Survey of Vehicle Energy Use, an extensive survey of

automobiles and light trucks under 3.5 tonnes. Though the data have some significant shortcomings they provide valuable insights into the energy use and efficiencies of this most important transport mode. This study by no means exhausts the usefulness of this data base for energy use and conservation analysis. The National Survey will very likely serve as a valuable resource for research studies for years to come.

50033 **Predictive intercity freight network models: The state-of-the-art.** Friecsz, T.L.; Harker, P.T.; Tobin, R.L. (University of Pennsylvania, Philadelphia, PA). *Transportation Research, Part A: General;* 17A: No. 6, 409-417(Nov 1983).

This paper describes significant network models for predicting intercity freight movements that have appeared in the literature, and it provides a typology of such models. An in-depth discussion is provided of recent advances pertaining to combined shipper-carrier models, spatial price equilibrium, and the use of these concepts to enhance the realism and accuracy of intercity freight network models. Finally, areas for future research are recommended.

3203 Industry And Agriculture

REFER ALSO TO CITATION(S) 32030049498, 49710, 49942, 49943, 49969, 49970, 49971, 49972, 49973, 49974, 49975, 49976, 49977, 49978, 49979, 49999, 50405, 50433

50034 **(DOE/CE/40654—T1) Manufacturing costs, equipment needs and technological opportunities among small and medium-size manufacturers.** Kirsch, F.W. (University City Science Center, Philadelphia, PA (USA)). May 1984. Contract FC01-83CE40654. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000479.

During a series of 54 performance evaluation interviews conducted during March and April, 1984, 15 plant representatives were chosen for a further confidential interview about their plants' overall manufacturing costs, their equipment needs, and the opportunities they envision for research, development, and technology transfer. This brief report summarizes these manufacturers' response to a series of questions designed to elicit useful information about: the factors that contribute most to their plants' manufacturing costs; the manufacturers' preferred approaches to increasing their plants' profitability; perceived management needs for new equipment, its availability, and barriers to purchasing it; plant management's attitude toward the potential for research and development (R and D) to improve product quality; and the same persons' estimates of whether the R and D will be done within five years (if needed) and by whom. In addition to summarizing that information, this report offers an analysis of the patterns which these responses reveal and presents observations about the priorities which they indicate.

50035 **(DOE/CS/40091—T5) Program of direct energy efficiency improvement for medium-size and small manufacturers. Energy Analysis and Diagnostic Centers phase three of the 1981 to 1983 program .** Maginn, J.C.; McCann, L.L. (University City Science Center, Philadelphia, PA (USA)). Apr 1984. Contract AC01-78CS40091. 57p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85000544.

The Energy Analysis and Diagnostic Center (EADC) program provided individualized energy audits to 124 small and medium-size manufacturers during the third phase of the 1981 to 1983 program period. This report presents a compilation and analysis of the energy consumption patterns in these plants and of the EADCs' recommendations to improve the efficiency of energy use and to lower its cost. This report is composed of two chapters discussing various individual and collective aspects of the EADCs' accomplishments in specific industries, for particular energy sources, and according to categories of energy use and types of recommendation made and comparing them with preceding results. A third chapter discusses educational aspects of the program.

50036 **(DOE/EI/02295—T2) Mathematical model of the electric arc furnace. Final report.** Szekely, J. (Massachusetts Inst. of Tech., Cambridge (USA)). Jul 1982. Contract AM01-76EI02295. 168p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE85000718.

Electric Arc Furnace Steelmaking is responsible for some 25% of the steel produced in the US and this proportion is likely to grow in the future. This operation consumes some 1.4 x 10^{10} kWh annually at an overall process efficiency of about 60 to 75%. The purpose of this program has been to develop a mathematical model representing the energy transfer in electric arc furnaces with the objective of defining means for the optimization of the system, such that the energy consumption is reduced. Through the statement of the appropriate transport equations, subject to certain simplifying assumptions, a mathematical model has been developed to represent heat and fluid flow phenomena in the arc, the interaction of the arc with the bath, and bath circulation in electric arc furnaces. While there is a paucity of reliable information for the critical testing of the model as a description of industrial scale arc furnaces, there is enough data on plasmas, arcs and some industrial units to prove that the basic premises of the modelling effort are sound; indeed the predictions based on the model were found to be consistent with industrial scale measurements.

50037 (EPRI-EA—3530, pp 3.1-3.28) **Conservation as a utility planning option.** Gellings, C.W. (Electric Power Research Inst., Palo Alto, CA). May 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920380. (CONF-830982—).

From National conference on utility conservation programs: planning, analysis, implementation; New Orleans, LA, USA (13 Sep 1983).

In their search to optimize systems, utility planners have begun to recognize the advantages of incorporating demand management. These programs involve changing the pattern and amount of consumers' electricity consumption. Among the categories of such activities are load management, electrification, load growth or increased market share and strategic conservation. Strategic conservation is the change in customer response which results from deliberate utility programs or activities to either accelerate or cause energy conserving actions that would not otherwise have taken place at that time or in that magnitude. This paper focuses on the conservation option that can be integrated into demand-side planning as a demand management alternative.

50038 (EPRI-EA—3530, pp 4.1-4.19) **Evolution of demand-side planning at PG and E.** Brennan, J.E. (Pacific Gas and Electric Co., San Francisco, CA). May 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920380. (CONF-830982—).

From National conference on utility conservation programs: planning, analysis, implementation; New Orleans, LA, USA (13 Sep 1983).

The development and accomplishments of energy conservation programs of the Pacific Gas and Electric Company (PG and E) are discussed. The description includes the motivating factors, organizational development and the influence of California regulatory bodies. The conservation program planning process is described, as well as its relationship to the corporate resource planning process. In addition, the concluding remarks address the short- and long-term benefits of such programs to PG and E.

50039 (EPRI-EA—3530, pp 5.1-5.12) **Vepco's Alternative Energy Study: incorporating and assessing energy conservation as a part of utility planning and goal formulation.** Barr, J.M. Jr. (Virginia Electric and Power Co., Richmond). May 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920380. (CONF-830982—).

From National conference on utility conservation programs: planning, analysis, implementation; New Orleans, LA, USA (13 Sep 1983).

A three-year study effort to assess the least costly alternatives to meet the future growth in electric power demand on the Virginia Electric Power Company system is discussed. The study encompassed both demand-side options (conservation, load management, and cogeneration) and supply-side options (alternative fuels, advanced generating technologies, and small-scale hydro). The supply side options included four alternative fuels: peat, wood, municipal solid waste, and coal-water mixtures. The study was struc-

tured to answer the important questions that allow for efficient planning and strategy development.

50040 (EPRI-EA—3530, pp 6.1-6.7) **Conservation: a regulator's view.** Pooler, R.S. (New York State Public Service Commission, Albany). May 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920380. (CONF-830982—).

From National conference on utility conservation programs: planning, analysis, implementation; New Orleans, LA, USA (13 Sep 1983).

This presentation describes two energy conservation projects: the work of the recently formed Ad Hoc Committee on Energy Conservation Experience of the National Association of Regulatory Utility Commissioners (NARUC), and a special proceeding initiated by the New York State Public Service Commission last year which is trying to define guidelines for utility expenditures in residential end-use conservation.

50041 (EPRI-EA—3530, pp 10.1-10.16) **Measuring effects of utility conservation programs: inputs to utility decision making.** Hirst, E. (Oak Ridge National Lab., TN). May 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920380. (CONF-830982—). Contract W-7405-ENG-26.

From National conference on utility conservation programs: planning, analysis, implementation; New Orleans, LA, USA (13 Sep 1983).

The evaluation of utility conservation program performance is discussed. The emphasis is on measurement - use of actual program-generated data (e.g., utility bills, customer self-reports on conservation actions, program cost data) - rather than a priori planning analyses to assess the worth of utility programs.

50042 (EPRI-EA—3530, pp 11.1-11.15) **Electric utility sponsored conservation programs: case studies of implementation experience.** Davis, T.D.; DeRosa, E.; Limaye, D.R. (Synergic Resources Corp., Bala Cynwyd, PA). May 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920380. (CONF-830982—).

From National conference on utility conservation programs: planning, analysis, implementation; New Orleans, LA, USA (13 Sep 1983).

Little is known about comparative electric utility experience in the design, implementation, marketing and evaluation of energy conservation programs. The experience of 13 electric utilities in conservation programming is reviewed. The mix of conservation programs offered was found to be based on utility system characteristics, corporate philosophy and regulatory intervention.

50043 (EPRI-EA—3530, pp 12.1-12.6) **Texas utilities' rebate program.** Osburn, T. (Texas Power and Light Co., Dallas). May 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920380. (CONF-830982—).

From National conference on utility conservation programs: planning, analysis, implementation; New Orleans, LA, USA (13 Sep 1983).

A discussion of the Texas Utilities companies' service areas and the companies' generating capability as well as the mix of the customer population is presented. The fact that the system is a summer peaking company comprised of primarily residential customers is discussed. A discussion of the typical home within the service area, and what could be done with energy-efficient equipment and the thermal integrity of the home to improve load factor and reduce kW on peak is presented. The development of the campaign items, the establishment and justification of the incentive levels and the efficiency levels for air conditioning and heat pump systems are explored. The three operating subsidiaries' approaches to marketing the program and details of each subsidiaries' incentive levels are described. Finally, the impact the program has had on builders and contractors within the service area and also the results that have been attained since the initiation of the program are reviewed.

50044 (EPRI-EA—3530, pp 13.1-13.9) **Structuring energy conservation for results.** Petillo, J.T. (Florida Power and Light Co., Miami). May 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920380. (CONF-830982—).

From National conference on utility conservation programs: planning, analysis, implementation; New Orleans, LA, USA (13 Sep 1983).

The capital costs incurred by new generating stations and high reliance on oil in its fuel mix prompted Florida Power and Light to pursue aggressive energy conservation and marketing strategies. These strategies have been both positively and negatively affected by a state energy conservation policy that includes stringent goals and codes established by regulatory bodies. Though the question of the need for regulatory mandates continues to be an intriguing one, FPL has found its varied energy conservation programs to be of benefit in the following areas: helping defer expensive power plant construction, yet still meeting increasing energy demand due to customer growth; keeping fuel costs down; and consumer satisfaction. FPL has enhanced the mandated residential audit program with a variety of innovative incentives designed to obtain positive results. In a survey published by FPL, the utility found that the audit does not generated significant savings. However, FPL was able to use the audit as a marketing entry to sell its incentive program. Success of FPL's program comes not just because the company offers a varied energy conservation program, but because of the way it has structured the marketing of the programs in the face of current general public apathy regarding the energy situation. And the company's evolving marketing strategy seeks to capitalize on the utility's growing need to formulate a broad energy management program for the future that goes beyond emphasizing conservation.

50045 (EPRI-EA—3530, pp 16.1-16.10) **Energy conservation and utility marketing strategies: is there a conflict?.** Mitchell, R.C. III. (Arkansas Power and Light Co., Little Rock). May 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920380. (CONF-830982—).

From National conference on utility conservation programs: planning, analysis, implementation; New Orleans, LA, USA (13 Sep 1983).

There has been a dramatic increase in interest in the energy conservation marketing function within the electric utility industry. The impetus for this increased attention is a cause for concern. The causes for this concern are discussed. Many in the industry view a return to utility marketing as the absolute antithesis of previous energy conservation efforts, and perhaps even load management, as well. This perceived conflict is discussed.

50046 (EPRI-EA—3530, pp 23.1-23.24) **Conservation in a load/resource planning and analysis process.** Wright, S.; Norman, P.; Esvelt, T.; Armstrong, D.; Hickey, S. (Bonneville Power Administration, Portland, OR). May 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920380. (CONF-830982—).

From National conference on utility conservation programs: planning, analysis, implementation; New Orleans, LA, USA (13 Sep 1983).

The Pacific Northwest Power Planning and Conservation Act signed in December 1980 mandated that the Bonneville Power Administration acquire conservation as it would any other power resource. Since that time BPA has been developing and improving a load/resource planning and analysis process which integrates conservation as a resource. The methodology, which is now in use at BPA, is designed to assure that conservation and any other resource acquisitions are tied to the need for power. Recent projections from this process indicate that the Pacific Northwest, like many other regions of the country, is likely to have a surplus of power through the 1980's. However, this analysis also indicates that it would be wise to continue acquiring conservation savings in the near term as a means of achieving a least cost mix of resources over the 20-year planning period. In fact, it appears that the region can rely primarily on conservation and small hydroelectric resources to meet the projected need for power over the planning period. An overview of the methodology is presented, the individual models

which are used are reviewed, and the conclusions which are drawn are discussed.

50047 (EPRI-EA—3530, pp 24.1-24.19) **Segmenting markets for conservation.** Williams, M.V. (Southern California Edison, Rosemead). May 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920380. (CONF-830982—).

From National conference on utility conservation programs: planning, analysis, implementation; New Orleans, LA, USA (13 Sep 1983).

Utility application of customer segmentation to programs and end-use models is presented. This is done in the context of attitude and customer choice models. It is concluded that existing data provides a basis for model improvements; however, further research and model development are required for formal strategic planning using customer attitude data. Attitude literature is reviewed and attitudes are shown to be predictive of intent rather than directly predictive of behavior. Data are presented which derives from basic attitudes toward conservation: cynicism, concern for supply, avowal of social norms, and home economics. Data are provided which employ these attitudes to predict intent to conserve. Use of segmentation is reviewed, and a demonstration of segmentation by attitude and demographics is provided. Six demographic segments, Homeowning Couples, Large Households, High Income Newcomers, Older Californians, Young Renters, and Low Socioeconomic Status Females, are derived. Similarly, four attitude segments, Disbelivers, Economizers, Intervention Supporters, and Marketplace Supporters are derived. The theory of consumer choice is reviewed, and it is argued the attitudes can be conceptualized as scaler weights of attributes in a preference space. Finally, the use of segmentation in end-use models is discussed. Short-term improvements relating customer segments to investment discount rates are recommended. Long-run solutions which relate product attributes to attitude and preference structures and then to market share allowing strategic implications of demand side options are briefly reviewed.

50048 (EPRI-EA—3530, pp 25.1-25.8) **Conservation as part of a utility market plan: lessons learned.** Solari, J.S.; Harper, J.P. (Tennessee Valley Authority, Chattanooga, TN). May 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920380. (CONF-830982—).

From National conference on utility conservation programs: planning, analysis, implementation; New Orleans, LA, USA (13 Sep 1983).

A utility's energy management plan can include both load building and load reduction programs to provide for more efficient use of electricity by the utility's end-use customers. Conservation programs are an important component of the utility energy management plan. Successful implementation of conservation programs requires a marketing approach. This approach recognizes consumer needs and motivations as essential elements in developing and evaluating the conservation marketing strategy. Market segmentation research is used to identify target market segments and to determine the size of those market segments. Financial incentive analysis is used to determine the level of incentives which are justified by the economic benefits of the program. Market tests can provide the data to determine the level and type of incentive necessary for the target market to purchase the product. Communications research provides information on how to reach the target audience and which product features or benefits to emphasize. Tracking and evaluating the success of the marketing plan is also an important marketing research function. In the process of developing and evaluating marketing strategies for its programs, TVA identified some problems and learned some lessons. Some of the problems involved data collection, storage, or analysis. Others stemmed from the practice of designing demonstration projects instead of test markets. In general, TVA conservation programs are becoming less technology-oriented and are incorporating more marketing research in their development and evaluation.

50049 (EPRI-EA—3530, pp 28.1-28.13) **EnergyCHECK commercial/industrial energy audit program.** Leahy, W.M. (Northeast Utilities Service Co., Hartford, CT). May 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920380. (CONF-830982—).

From National conference on utility conservation programs: planning, analysis, implementation; New Orleans, LA, USA (13 Sep 1983).

Many utilities are now in the process of considering the implementation of a commercial/industrial (C/I) energy audit program. Northeast Utilities Service Company (NU), providing electricity and gas to most of Connecticut and electricity to portions of Western Massachusetts, has been providing energy audits for its commercial and industrial customers despite the lack of a federal mandate. NU began offering this service to its 90,000 commercial and industrial customers under 1000 kW in early 1982, and as of September 1, 1983 had completed over 2200 audits. It now appears that the federally mandated Commercial and Apartment Conservation Services (CACS) will become required in the near future. NU's EnergyCHECK audit more than meets the requirements of the CACS program. It offers both a more inclusive analysis, as well as being available to many more customers than the CACS audit regulations require. NU's EnergyCHECK audit program is part of NU 80s/90s, a comprehensive and cohesive conservation program developed in response to an order from the Connecticut Department of Public Utility Control (DPUC) in 1981. NU identified the significant potential for conservation within its commercial and industrial sectors, a group relatively neglected in terms of receiving energy conservation information and assistance.

50050 (EPRI-EA—3530, pp 26.1-26.36) **Northern States Power Company Appliance Rebate Program.** Prifrel, J. (Northern States Power Co., Minneapolis, MN). May 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920380. (CONF-830982—).

From National conference on utility conservation programs: planning, analysis, implementation; New Orleans, LA, USA (13 Sep 1983).

A detailed description of the operation, initial results, evaluation, and possible future directions of Northern States Power (NSP) Company's Appliance Rebate Program is given. NSP started the program to offer rebates to its Minnesota residential electric customers for purchasing energy-efficient electric appliances March 1, 1982. Appliances covered under the program are room and central air conditioners, room and central heat pumps, electric water heaters, refrigerators, refrigerator-freezers and freezers. The goal of the program was to determine how successfully an appliance rebate program can shift the appliance market in Minnesota toward more efficient appliances. This shift will be accomplished by making consumers more aware of their life-cycle benefits, by offering financial incentives to consumers and by providing the appliance dealers and distributors with an added sales tool to help them market these appliances. Other program goals include evaluating the impact of this conserved energy on all aspects of the Company's system and determining if it is an effective substitute for future generating capacity. Program operation occurred in three distinct phases: an initial one-year pilot program stage (March 1, 1982 to February 28, 1983), a ten-month extension stage (March 1, 1983 to December 31, 1983), and an as-yet-undetermined future stage starting January 1, 1984.

50051 (EPRI-EA—3530, pp 27.1-27.9) **Great PG and E energy rebate.** Calhoun, R.C. (Pacific Gas and Electric Co., San Francisco, CA). May 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920380. (CONF-830982—).

From National conference on utility conservation programs: planning, analysis, implementation; New Orleans, LA, USA (13 Sep 1983).

The Great PG and E Energy Rebates from Pacific Gas and Electric (PG and E) will enable northern and central California businesses to save enough electricity to supply 20% of PG and E's residential customers for a year. The new incentive program offers PG and E's 500,000 commercial, industrial and agricultural customers rebates for purchasing and installing more energy-efficient motors, lighting and other equipment. The average rebate is about 40% of the purchase price of new equipment but may vary depend-

ing upon the cost of the item and its potential for energy savings. The rebates have a ceiling of $100,000 per customer per program and are offered to encourage businesses to invest in the energy-efficient equipment. Equipment installed through the new incentive program will help the participants save 3.49 billion kWh and 5.43 million therms. That translates into estimated energy savings of up to $296 millio

50052 **(N—84-22003) Survey of gas-side fouling in industrial heat-transfer equipment. Final report.** Marner, W.J.; Suitor, J.W. (Jet Propulsion Lab., Pasadena, CA (USA)). Nov 1983. 168p. (NASA-CR—173469; JPL-PUB—83-74). NTIS, PC A08/MF A01.

Gas-side fouling and corrosion problems occur in all of the energy intensive industries including the chemical, petroleum, primary metals, pulp and paper, glass, cement, foodstuffs, and textile industries. Topics of major interest include: (1) heat exchanger design procedures for gas-side fouling service; (2) gas-side fouling factors which are presently available; (3) startup and shutdown procedures used to minimize the effects of gas-side fouling; (4) gas-side fouling prevention, mitigation, and accommodation techniques; (5) economic impact of gas-side fouling on capital costs, maintenance costs, loss of production, and energy losses; and (6) miscellaneous considerations related to gas-side fouling. The present state-of-the-art for industrial gas-side fouling is summarized by a list of recommendations for further work in this area.

50053 **(NP—4770476) Analysis of the technical and energetical operation behavior of cogenerati0n plants.** Jensch, K. (Technische Univ. Muenchen (Germany, F.R.). Fakultaet fuer Elektrotechnik). 4 Nov 1982. 225p. (In German). NTIS (US Sales Only), PC A10/MF A01. File Number DE84770476.

For new system combinations like the block heating power plant technology, components developed for different operational conditions like internal combustion engine, generator and heat exchanger are used in combination with the relevant control equipment. Justified statements on the operational behavior can only be obtained in field tests during practical application with its numerous boundary conditions and interdependencies. Thus, the testing of different BHPO with different design and size during the real operation is the aim of the present work in the framework of long-term measurements. Additional measurements have been carried out on a testing bench. Here, energy fluxes were measured during full load and part load operation. The results of the field tests elucidate the decisive influence of the characteristics of the power and heat demand of the object to be supplied and of the plant design on the mode of operation of the plant components as well as on the relevant coincidence fractions of the generation on the demand. On the base of the measurements, computer programs have been developed, which allow an energetical and economical optimization and which give the frame for an energy-economical judgement of this technology.

50054 **(NP—4901778) Demonstration of furnace curtains to reduce heat energy. Final report.** Burgess, V.E.; Wahle, H.W.; LaCount, D.F.; Seibert, K.D. (Babcock and Wilcox Co., Alliance, OH (USA). Research and Development Div.). Feb 1980. 65p. Dept. of Development, Div. of Energy, Box 1001, Columbus, OH 43216. File Number TI84901778.

A gas-fired forging furnace was operated in a steady state for a range of temperatures from 1500° to 2100°F, both with and without two types of ceramic furnace curtains over the door opening. To simulate a throughput of workpieces, a water cooled heat sink was placed on the furnace hearth for half the tests. This simulated a relatively light load at about 10% of rated furnace capacity. Gas consumption rate and furnace temperatures were measured for a total of 18 test runs. For the runs without the simulated furnace load (i.e., empty furnace), the furnace curtains reduced gas consumption by 43 to 68%. For those runs with the simulated load, the reduction in gas consumption was 25 to 33%. This indicates that the benefits of furnace curtains are a maximum without a load, and are reduced as the load increases. The furnace was fired at its maximum rate from room temperature to 2200°F, both with and without curtains over the door opening. A total of 5 different curtain materials were tested - 4 refractory cloth type and 1 metallic type. Although anomalous results were obtained at lower temperatures, it was found that to reach 2200°F the furnace curtains reduced gas usage by 15 to 22% and time required by 7 to 22%. The metallic curtain had the best overall gas savings with a 22.3% reduction.

50055 **(NP—4901794) Use of furnace curtains to reduce energy consumption in glass annealing furnaces.** Wexler, J. (Anchor Hocking Corp., Lancaster, OH (USA)). [1984]. 53p. Dept. of Development, Div. of Energy, P.O. Box 1001, Columbus, OH 43216. File Number TI84901794.

An experimental study on energy and mass balance and the associated effects of installing curtains in a typical annealing furnace used in the glass industry is reported. Only lehrs operated on natural gas were considered. Review of the annealing process, the lehr selection process and its structural details are given. Instrumentation and data collecting procedures are discussed. Results are given for eight monitored items spanning weight and height ranges from 0.328 to 2.17 pounds, and 3.09 to 9.50 inches, respectively. Base line data were established by continuous data-logging, and results were compared to data collected after curtains installation. Construction details of the curtains are given. Comparison of results showed a savings of 7.7% in natural gas consumption in the pre-heating and annealing zone for tall items. Greater savings are expected with short-item runs. Energy utilization factors of lehr and belt heaters under current operating conditions are given.

50056 **(NP—4901795) Ohio cogeneration handbook.** (Resource Dynamics Corp., McLean, VA (USA)). Jun 1982. 131p. Dept. of Development, Div. of Energy, P.O. Box 1001, Columbus, OH 43216. File Number TI84901795.

A first-cut feasibility assessment of a site's potential for cogeneration is presented. If the characteristics of a particular site meet the minimum requirements to support a cogeneration facility, a detailed assessment of technical and economic feasibility should be undertaken. The methodology for performing this assessment is presented. Financing and ownership options are discussed; regulatory requirements are summarized; and details of Ohio's air quality requirements are presented. A case study application of the feasibility methodology is included as Appendix A.

50057 **(OEFZS—4277) Immobilization of toxic waste by embedding into bitumen.** Knotik, K.; Winkelhofer, W. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). Apr 1984. 20p. (In German). (CH—331/84). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703142.

The VEW-OEFZS drying and bituminization plant for the conditioning of hazardous waste operates on the basis of a vacuum-sedimentation process. The advantages of this process are - non-contaminative operation in a closed system under vacuum - separate drying and embedding phases, no steam distillation of bitumen, no need for tar filters - the sedimentation process can also be used for the embedding of all types of solid, granular wastes (vacuum-impregnation), also for the conditioning of spent ion exchange resins.

50058 **(PB—84-214378) Gas turbine topping cycle industrial cogeneration system. Annual report January-December 1983.** Leibowitz, H.M. (Mechanical Technology, Inc., Latham, NY (USA)). 30 Apr 1983. 62p. (MTI—84TR38). NTIS, PC A04/MF A01.

A gas turbine topping cycle cogeneration system is being developed to specifically meet the needs of industrial cogenerators in the 2-10 MWe range. Emphasis is placed on system integration. A single, prime reliable drive train and a single control center replace a wide assortment of nonintegrated, free-standing power drives and control centers. The system produces a nominal 3 MWe of power and 19,500 lb/hr of 250 psig saturated steam using an Allison 501-KH gas turbine and a natural circulation waste heat boiler. A steam injected feature is employed to increase output to 4 MWe when process steam demand diminishes. The system is prepackaged, skid-mounted and delivered in four modules; one each for the machinery, duct burner, waste heat boiler and controls. A demonstration in a General Motors plant is planned in 1985.

50059 **(PB—84-214386) Development of an advanced, microprocessor-based control subsystem for gas-fired, packaged cogeneration systems. Annual report February 1983-February 1984.** Aasen, R.K. (Honeywell, Inc., Roseville, MN (USA). Technology Strategy Center). Feb 1984. 34p. (R—84056). NTIS, PC A03/MF A01.

The overall objective of this program is to develop and demonstrate a microprocessor-based, supervisory control subsystem that addresses gas-fired cogeneration control needs. The controller will be standardized to function with a variety of packaged cogeneration systems. Work to date emphasized the evaluation of cogeneration control needs and microprocessor control hardware capabilities. Members of the cogeneration community were contacted and visited; their input was also solicited via questionnaires. Extensive investigation of both Honeywell and outside controls resources was conducted. Detailed control strategy analysis was conducted; promising approaches were evaluated in detail via computer simulation. Following the assessment and analysis, a baseline concept was defined.

50060 **(PB—84-215425) Survey of flue gas condensation heat recovery systems. Final report February-October 1981.** Goldstick, R.J. (KVB, Inc., Irvine, CA (USA)). 18 Dec 1981. 471p. (KVB—13-45400-1289). NTIS, PC A20/MF A01.

See also PB83-211888.

This program was conducted to evaluate the state of the art of commercial condensation heat recovery systems. These heat recovery systems are capable of improving boiler thermal efficiency by 10-15 percent when firing natural gas and have wide applications for fuel oil and solid fuel firing due to the combined effect of waste heat recovery and emissions reduction. Twenty-two manufacturers were surveyed and twenty-eight users of various types of equipment were contacted. Design limitations, costs and OandM considerations were reviewed. Applications ranged from small commercial users (swimming pools, hotels, laundries) to large pulp and paper, textiles and chemical industries. The primary limitation to this heat recovery technique is the low temperature of the output stream (120-180F). Consequently, a number of typical industrial scenarios were investigated (food processors, textiles, chemicals) and simple paybacks estimated. In addition, a survey of 35 industrial users was used to develop a payback distribution. Typical payback periods were six months for industrial applications with 8000 hours/year operation to three years for comfort heating applications with 2000 hours/year operation. An assessment of the National Energy Conservation Potential was made using an industrial boiler inventory and industrial fuel use and demand profile. Savings of 280 x 1012 Btu/yr can be realized with two year or less paybacks.

50061 **(PNL-SA—12256) Monitoring technology trends with patent data: fouling of heat exchangers. A case study.** Levine, L.O.; Watts, R.L. (Pacific Northwest Lab., Richland, WA (USA)). Apr 1984. Contract AC06-76RL01830. 7p. (CONF-840816—22). NTIS, PC A02/MF A01; GPO Dep. File Number DE85000355.

From 22. national heat transfer conference; Niagara Falls, NY, USA (5 Aug 1984).

Trends in techniques for the prevention, mitigation, and removal of fouling of industrial heat exchange equipment was assessed by Battelle, Pacific Northwest Laboratories in a study performed for the US Department of Energy. This assessment utilized patent activity, telephone interviews, literature reviews, vendor catalogs, and consultants. Analysis of 231 patents relevant to both gas-side and liquid-side fouling revealed that these inventions concern a diffuse area characterized by many application specific problems. The rate of patent activity has increased modestly since 1973.

3206 Municipalities And Community Systems

REFER ALSO TO CITATION(S) 32060049906, 50551

50062 **(ANL/EES-TM—251) Evaluating applications of heat recovery incinerators: information and approaches.** Hub, K.; Gillette, J.; Chiu, S.Y. (Argonne National Lab., IL (USA)). 6 Apr 1984. Contract W-31-109-ENG-38. 69p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85001419.

The work is reported in three categories: review of methodology, assembly of selected data and information that can be used in the different tiers of evaluation, and definition of the general evaluation approach for such things as steam production schedule and site selection. In section 2 the review of the tier 1 methodology is discussed; however, the actual comments, which were submitted early in the project, and the tier 1 flow schematic are included in the appendix. Section 3 contains information for the methodology, some of which was initially submitted with the tier 1 review but was later upgraded and expanded. Section 4 covers the selection of the steam production schedule, the factors in site selection, regional landfill costs and a method for estimating these costs, and finally pollution control considerations.

50063 **(BFR-R—103:1983) Waste heat recovery from waste water with a heat pump for 400 flats in Falun. Project plan.** Backman, A. (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1983. 25p. (In Swedish). NTIS (US Sales Only), PC A02/MF A01. File Number DE84751659.

This report describes the design of a heat pump plant and its connection to an existing heat distribution system. Purified waste water at a rate of 2-300 m^3/hour is fed to the heat pump evaporator. The waste water temperatue is lowered by about 3°C (from 5°C to 2°C); 1.3-1.4 MW of heat is extracted at a temperature of about 70°C. The heat pump is equipped with a screw compressor with a 10 kV/530 kW water cooler motor. Heat from the cooling water is recovered. The district heating system supplies heat to about 350 apartments, 50 one-family houses and to a local school. The total investment amounts to 2.9 MSEK (about 0.36 Mdollar), and the yearly savings in fuel oil consumption to 650 m^3/year.

50064 **(BFR-R—107:1983) Lake water heat for a heating central at Kvarnberget, Falun, Sweden. Preliminary study.** Annerskog, R.; Bustad, T. (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1983. 35p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. File Number DE84751658.

The technical and economic feasibility of using an electric heat pump with a lake as heat source for district heating at Falun, Sweden is discussed. The heat pump plant would supply 70 percent of the heat for an area with approx. 500 apartments with a total floor area of about 50000 m^2. Heat would be taken from a lake inlet with a depth of 6-7 m. Winter temperatures at the bottom are not lower than 2-3°C. Total heat supplied by the heat pump is 1.25 MW. At top load, the existing oil-fired heating plant will assist the heat pump. Total investment cost is estimated to 6.2 MSEK (about 0.78 Mdollar). Saving in operating cost is estimated to 0.92 MSEK/year (about 0.12 Mdollar).

50065 **(DOE/NBM—4016871) Development of a community energy conservation program. Guide to organizing and managing a program. Volume I.** (Urban Systems Research and Engineering, Inc., Cambridge, MA (USA)). 11 Jan 1977. Contract EM-78-C-01-5313. 39p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84016871.

Volume I covers the necessity for local energy conservation programs and the development of a policy statement and implementation guidelines. Sources of assistance available to local governments are discussed. (MHR)

3209 Education And Public Relations

REFER ALSO TO CITATION(S) 32090049942, 50035, 50065

50066 (DOE/R4/10320—T1) Urban Self-Reliance House. Final technical report. (Center for Human Development, Jackson, MS (USA)). Dec 1983. Contract FG44-80R410320. 21p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000311.

A credible job of introducing some new ideas on energy conservation to the people in Jackson, Mississippi was done. The project which received the most favorable response are continuing (recycling, weatherizing, coops and school gardening) on a self-sustaining basis. Some concepts like solar heating are still too exotic for the public here to get serious about. Proof of the success of the efforts is the invitation to help Southwestern College in Winfield, Kansas set up a Center for a Sustainable Future. It is recommended that lasting changes need to be quickly institutionalized such as getting gardening into the public schools. It is difficult to sustain new ideas otherwise, both in terms of raising funds for non-profit groups and in reaching large numbers of people.

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

3301 Internal Combustion Engines

REFER ALSO TO CITATION(S) 33010050136

50067 (AD-A—140964/8) Military adaptation of commercial items (MACI) laboratory evaluation of the Code E-430 engine. Final report. Rimpela, R.J.G. (Army Tank-Automotive Command, Warren, MI (USA)). Feb 1984. 130p. (TACOM-TR—12910). NTIS MF A01.

The project determined the military adaptability of the Code E-430 engine through laboratory testing and evaluation. The engine was installed in a dynamometer test cell at US Army Tank-Automotive Command (TACOM) and conventional dynamometer testing procedures were used to determine basic engine characteristics. The characteristics determined were: full-load performance, fuel economy at full-load and part-load, engine oil consumption, engine heat rejection, and exhaust smoke density.

50068 (AD-A—140996/0) Military adaptation of commercial items: laboratory evaluation of the Code E-436 engine. Technical report 17 January-28 July 1983. Rimpela, R.J.G. (Army Tank-Automotive Command, Warren, MI (USA)). Feb 1984. 142p. (TACOM-TR—12909). NTIS MF A01.

The engine was installed in a dynamometer test cell at US Army Tank-Automotive Command (TACOM) and conventional dynamometer testing procedures were used to determine basic engine characteristics. The characteristics determined were full load performance, fuel economy at full load and part load, engine oil consumption, and engine heat rejection. During pre-endurance testing, the Code E-436 engine produced 378 observed kW (506.4 BHP) at full load, at rated speed of 2,600 RPM. The maximum torque during full load operation was 1439 Nm (1061 lb-ft) at 2,400 RPM. Minimum brake specific fuel consumption at full load occurred at 2,200 RPM and was 217 g/KWH (0.356 lb/BHP-HR). After the NATO Endurance Test the engine produced 375.1 observed kW (503.0 BHP) at full load and rated speed. The maximum torque was 1423.8 Nm (1050 lb-ft) at 2400 RPM. The total lube oil consumption during the 400-hour NATO endurance was 19.7 kgs (43.4 lbs). Following the endurance test visual and dimensional inspection of the engine revealed all major engine parts to be in excellent condition except for pistons. Five out of eight pistons developed cracks in the pin bores. Though the engine completed the endurance test (400 hours) and was operated for a total of 582 hours, the engine is considered as having failed the 400-hour NATO test due to piston failure.

50069 (BMFT-FB-W—84-019) Increase of efficiency in cooled high temperature turbines. Phase I. Dietrichs, H.J.; Happel, H.W.; Heinig, K. (Motoren- und Turbinen-Union G.m.b.H., Muenchen (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). May 1984. 128p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE84752109.

Within the scope of the BMFT-Programme "Increase of efficiency in cooled high temperature turbines" MTU carried out an extensive experimental and theoreitcal study in order to improve the accuracy and cost effectiveness in the aerodynamic design of highly loaded HP-turbines. The study included the following subjects: - aerodynamic and heat transfer test in cold air rigs and demonstrator engines, - inverse design of aerofoils, - further development of a turbine noise calculation method, - basic studies for the development of a inviscid 3D-code. This report gives a summary of the results that were achieved during the phase I (1981-82) of this programm.

50070 (CONF-8004243—, pp 1-10) **Diesel engine for passenger cars with and without supercharging.** Kittel, G. 1980. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI84770472.

From Conference on fuel-saving driving systems; Zwickau, German D.R. (17 Apr 1980).

Crude oil has become a problem in terms of supply and price development. Road transport has to be organised with a minimum of crude oil. The aim for the next five years which is to reduce fuel consumption by 40% can only be solved by a complex strategy. This involves first of all a high efficiency of the vehicle itself, it further means to lengthen the service life of the car by maintenance and suitable control measures, to implement a fuel-saving way of driving and to improve the traffic flow by more adequate planning. According to present-day knowledge the combustion engine will be the main drive for cars for the next 10-20 years wich means that the use of diesel engines for passenger cars will become more important as a medium-term solution for fuel-saving drives. The report supplies information on the reasons for introducing diesel engines in passenger cars, an assessment of the trends, advantages and disadvantages of the diesel engine in passenger cars, information on the technical state of diesel engines (combustion method, injection system, exhaust gas turbocharging). Results of tests with the VW-Golf diesel engine (1,5 l) are mentioned.

50071 (CONF-8004243—, pp 11-26) **Diesel engine for with and without supercharging.** Caspari, G. 1980. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI84770472.

From Conference on fuel-saving driving systems; Zwickau, German D.R. (17 Apr 1980).

The diesel engine, when compared to the otto-engine is characterised by: lower fuel consumption greater fuel indifference, lower emission of pollutants such as carbon monoxide and unburnt hydrocarbons. Possibilities to further reduce fuel consumption are investigated for the diesel engine. Starting from a cost analysis the author reports on combustion processes for diesel engines with small cylinder capacity, on driving time shares in the engines performance characteristics and on results of comparative tests (effective and induced characteristic values). Reducing the power loss and exhaust gas turbocharging are dealt with in detail. Characteristic performance of aspirating engines and turbocharged engines. Details on exhaust gas turbocharging and charge-air cooling are given, exhaust gas turbocharging with charge-air cooling and resonance tube system. Finally criteria for engine design are given and explained.

50072 (CONF-8004243—, pp 27-48) **New knowledge in carburetor construction.** Freche, F. 1980. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI84770472.

From Conference on fuel-saving driving systems; Zwickau, German D.R. (17 Apr 1980).

Demands of environmental protection for reduced emission of pollutants have speeded up the further development of the carburetor in recent years. Improved idle systems with circulating air channels which are quality controlled, adjusted and measured by

the producer before delivery to the engine manufacturer have proved themselves already. Carburetors with electronic control systems are being developed presently. They represent a better and cheaper solution when it comes to observing exhaust gas regulations which are expected to become stricter. A comparison between carburetor and injection leads to the conclusion that the only disadvantage of the four-stoke engine with electronically controlled carburetor consists mainly of a partly greater lambda-dispersion with regard to mixture distribution, the consequence of which is a somewhat increased content of pollutants in the exhaust and higher fuel consumption. Use of central injection is expected to bring about problems in mixture distribution.

50073 (CONF-8004243—, pp 49-93) **Prospects of the otto-engine with carburetor, fuel injection and stratified charge.** Kuentscher, V. 1980. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI84770472.

From Conference on fuel-saving driving systems; Zwickau, German D.R. (17 Apr 1980).

At present most otto-engines are still equipped with a carburetor. Demands of fuel saving and low-pollutant exhaust gas however asks for more complicated carburetor constructions with various additional features. Design of the induction pipe becomes more complicated and sophisticated in order to reduce the problems of fuel-air ratio and mixture distribution especially in the cold-start and warm-up phase. The tendency, that the future lies in fuel injection has been forecast ten years ago and confirmed by reality. The advantages of fuel injection are elaborated in this construction: fuel saving compared to the carburetor, lower pollutant content of the exhaust gases, possibility to improve the performance. Electronically controlled injection x systems offer the possibility to produce an engine with optimised consumption for all engine performance characteristics, provided that ignition is also controlled electronically. The parallel tendency to use more diesel engines for passenger cars is also quite clear and due to considerations of energy policy.

50074 (CONF-8004243—, pp 111-118) **Possibilities of electronics and microelectronics for optimation of the fuel consumption of cars.** Dziwisch, G.F. 1980. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI84770472.

From Conference on fuel-saving driving systems; Zwickau, German D.R. (17 Apr 1980).

Electronics in cars have established themselves internationally not only because the increase in safety and comfort but also where optimation of energy transformation is concerned. Those elements and functional groups have to operate in wide ranges of operational temperature, they have to have a high tolerance for shocks and vibratory stresses, they must be resistent against air humidity and against aggressive and corrosive media. Further demands are: indifference to fluctuations of the voltage, active and passive interference safety, high reliability, low price. They can be used in: engine (electronic ignition, fuel metering, speed control); power transmission (automatic gear); control equipment (indication of momentary fuel consumption, board diagnosis, speed warning system, indicator for position of choke and handbrake). Further possibilities for successful use of microlectronics and electronics are recording and processing of traffic flows for tasks of traffic planning and channeling, optimization of routing, traffic stream control and utilization of transport capacities.

50075 (CONF-8004243—, pp 119-137) **Some connections between the efficiency degree of combustion engines and the fuel consumption of the vehicle.** Behrens. 1980. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI84770472.

From Conference on fuel-saving driving systems; Zwickau, German D.R. (17 Apr 1980).

Two parameters are used for test of economic fuel consumption of engines. On the one hand one uses comparisons of engine characteristic graphs in which the lines of constant specific fuel consumption are used as parameters. A further comparison is made on the basis of drive tests with cars equipped with different engines and operated under defined conditions. The values of economy determined with the two methods varied strongly. The characteristic graphs for example do not express the consumption advantages that can be achieved by operating the car with diesel. The reasons for these differences are explained with the help of diagrams. Hints on the frequency distribution of the parameters which have an impact in the characteristic diagram of the engine are given and information is given of the fuel savings in percent of various European gasoline- and diesel engines for passenger car. Result of the research: optimation of engines in tests must be careful to place the minimum of specific fuel consumption in the part of the characteristic diagram where efficiency is at its highest.

50076 (CONF-8004243—) **Fuel savings by advanced vehicle drive systems.** Meissner, F. (Ingenieurhochschule Zwickau (German Democratic Republic)). 1980. 164p. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number DE84770472.

From Conference on fuel-saving driving systems; Zwickau, German D.R. (17 Apr 1980).

Separate abstracts were prepared for individual papers. (MHR)

50077 (LRAP—18) **Ignition probing by laser techniques. Preliminary experiments.** Alden, M.; Borgstroem, H.; Edner, G.; Holmstedt, T.; Hoegberg, T.; Svanberg, S. (Tekniska Hoegskolan, Lund (Sweden)). Oct 1982. 22p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84751666.

The present paper reports preliminary work on the use of Coherent Anti-Stokes Raman Spectroscopy CARS, to study rotational and vibrational temperatures of N_2 as a function of time. The macroscopic behaviour of the gas mass following the spark discharge is treated solving the relevant differential equations. In this way some aspects of the spectroscopic signal behaviour are illuminated. The generation of sparks and the optical set-up are described and the measurements are presented. Finally, the results are discussed and some suggestions for future work are given.

50078 (N—84-20878) **Development of a simplified procedure for cyclic structural analysis.** Kaufman, A. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Mar 1984. 20p. (NASA-TP—2243; E—1855; CONF-840611—2). NTIS, PC A02/MF A01.

From International gas turbine conference and exhibit; Amsterdam, Netherlands (4 Jun 1984).

Development was extended of a simplified inelastic analysis computer program (ANSYMP) for predicting the stress-strain history at the critical location of a thermomechanically cycled structure from an elastic solution. The program uses an iterative and incremental procedure to estimate the plastic strains from the material stress-strain properties and a plasticity hardening model. Creep effects can be calculated on the basis of stress relaxation at constant strain, creep at constant stress, or a combination of stress relaxation and creep accumulation. The simplified method was exercised on a number of problems involving uniaxial and multiaxial loading, isothermal and nonisothermal conditions, dwell times at various points in the cycles, different materials, and kinematic hardening. Good agreement was found between these analytical results and nonlinear finite-element solutions for these problems. The simplified analysis program used less than 1 percent of the CPU time required for a nonlinear finite-element analysis.

50079 (N—84-21905) **Elevated temperature biaxial fatigue.** Jordan, E.H. (Connecticut Univ., Storrs (USA)). Aug 1983. 21p. (NASA-CR—173473). NTIS, PC A02/MF A01.

Biaxial fatigue is often encountered in the complex thermomechanical loadings present in gas turbine engines. Engine strain histories can involve non-constant temperature, mean stress, creep, environmental effects, both isotropic and anisotropic materials and non-proportional loading. Life prediction for the general case involving all the above factors is not a practicable research project. The current research program is limited to isothermal fatigue at room temperature and 1200 F of Hastalloy-X for both proportional and non-proportional loading. An improved method for predicting the fatigue life and deformation response under biaxial cycle loading is sought.

50080 (NP—4770523) Influence of particles in diesel engine exhaust gas during cooling and mixing with the surrounding air. Reichel, S. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Maschinenwesen). 21 Feb 1983. 159p. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number DE84770523.

The present situation in the car industry is characterised by the search for possibilities to restrict energy consumption and to limit the emission of pollutants posing a health hazard. The term "particulate" incorporates everything in solid and liquid phase which can be collected in a filter under atmospheric conditions. Particulates are mainly made up of pure carbon, and deposited hydrocarbons, of hydrocarbon aerosols, and of sulfite compounds. The formation of particulates in the combustion chamber and the influence of the particulate phase after leaving the combustion chamber was studied on diesel engine exhaust gases. Parameters studied included exhaust gas temperature, hydrocarbon composition, dilution ratio, temperature of the mixture, flow and mixing ratios, filter temperature and filter loading time. A theoretical model serves to describe and explain the experimentally determined dependence of particulate concentration on displacement ratio and on the temperature of the mixture. The results are summarized in an overview comprising 18 points.

50081 (NP—4770524) Reduction of emission of particles, carcinogenic polycyclic hydrocarbons and nitric oxides of a direct injection diesel engine by the diesel-gas process. Tesarek, H. (Technische Hochschule Darmstadt (Germany, F.R.). Fachbereich Maschinenbau). 5 Feb 1982. 180p. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number DE84770524.

Soot production in the conventional diesel process commences with the combustion of fuel droplets of the heterogeneous fuel/air mixture. If part of the liquid fuel is replaced by combustible gas here natural gas is added to the intake air) and only a small amount of liquid fuel is injected for self-ignition purposes, then soot formation, or more precisely particle formation, can be significantly reduced and with it the formation of biologically active polycyclic aromatic hydrocarbons (PAH). The amount of gas in proportion of the total fuel energy conversion determines the extent of particle reduction and thus PAH-emission. The disadvantages of this so-called diesel-gas process, particularly in the lower part load range, compared to the diesel-based process are the increased emission of combustible pollutants, coupled with higher fuel consumption. Both disadvantages can be largely counteracted by measures such as suppressing intake air and exhaust recycling, without significantly impairing the advantages of reduced emission. Preliminary criteria for assessing the quality of exhaust gases were obtained by gravimetric analysis of particle content of the exhaust for diesel-gas operation and for pure diesel operation, and also by separation of the particulate phase into benzene-soluble and insoluble fractions.

50082 (NP—4770531) Dissertation on a direct injection Diesel process with automatic control, dependent on load, of the ratio of the fuel adhering to the walls to that distributed in the air, with particular attention to exhaust gas turbo-supercharging and exhaust gas feedback. Melzer, H.H. (Technische Hochschule Darmstadt (Germany, F.R.). Fachbereich Maschinenbau). 31 Aug 1981. 237p. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE84770531.

The development of modern engines is marked by the conventional requirements for high output with as small a size as possible and low fuel consumption and a reduction of the emission of poisonous exhaust gases and low combustion noise. A newly developed direct injection Diesel combustion process is introduced as a contribution to fulfilling these requirements. In order to be able to combine the advantages of the two different forms of direct injection combustion, i.e., with the fuel distributed in the air and adhering to the walls, one is aiming at a process of combustion where the fuel clings like a film to the walls of the combustion chamber at full load, but is distributed over the air automatically with decreasing load, i.e., without external manipulation of controls, without showing the Diesel engine ignition knocking of conventional direct injection engines. Measures to improve the exhaust gas were of particular interest. The results of the investigations on a first low-speed experimental engine were transposed to a modern engine.

50083 A single cylinder engine study of lean supercharged operation for spark ignition engines. Schmid, K.R.; Johnson, R.T. (Mechanical Engineering Dept., Univ. of Missouri-Rolla, Rolla, MO). pp 139-152 of Power boosting. Vol. P-122. Warrendale, PA, USA; Society of Automotive Engineers (1983). (CONF-830201—).

From Society of Automotive Engineers congress; Detroit, MI, USA (28 Feb 1983).

A comprehensive test program was conducted using a single cylinder CFR engine to evaluate lean supercharged operation (LSO) of the spark ignition engine for improved efficiency. The intake manifold pressure and temperature and the exhaust pressure were controlled to simulate the addition of a turbocharger to the engine. Results of the experimental work indicated that LSO has the potential of improved engine efficiency and NOx emissions comparable to, or lower than, the naturally aspirated engine. For equal power output from the engine, efficiency increases of 14% were accompanied by reductions in Brake Specific NOx (BSNOx) emissions of approximately 76%. For a case of equal BSNOx emissions, an efficiency improvement of 6.4 points (over 40%) was observed. For operation at realistic lean supercharged conditions, the hydrocarbon and carbon monoxide emissions were not significantly different than those for the naturally aspirated engine. Exhaust energy estimates for the lean supercharged conditions tested indicated that sufficient exhaust energy is available to power a typical automotive type turbocharger.

50084 Improved spark ignition engine efficiency through lean turbocharged operation. Johnson, R.T.; Schmid, K.R. (Mechanical Engineering Dept., Univ. of Missouri-Rolla, Rolla, MO). pp 153-163 of Power boosting. Vol. P-122. Warrendale, PA, USA; Society of Automotive Engineers (1983). (CONF-830201—).

From Society of Automotive Engineers congress; Detroit, MI, USA (28 Feb 1983).

A production turbocharged V-6 engine of 3.8 liter (231 cu. in.) displacement volume was used in this study of lean turbocharged operation. The engine was modified for lean operation (A/F = 19-20:1) and manual control of the fuel flow, compressor discharge pressure, and EGR rates. Test conditions included loads and speeds to simulate road-load and 4% grade operating conditions, as well as constant intake manifold pressure tests. The results from the test program indicated that lean turbocharged operation has a potential for increased efficiency and reduced NOx emissions if operated at brake mean effective pressures of 500 kPa and above. For these operating conditions, HC and CO emissions are comparable to those of the naturally aspirated engine. NOx emissions were reduced by up to 50% over those for the naturally aspirated engine with EGR. Efficiency increases of up to 3 points (10%) were observed. Satisfactory detonation control for engines operating at these conditions will require comprehensive control of equivalence ratio, spark timing, and compressor discharge pressure.

3303 Electric-powered Systems

50085 (NP—4770530) Energy characteristics of road vehicles represented by the example of an electric transporter. Prechtl, H. (Technische Univ. Muenchen (Germany, F.R.). Fakultaet fuer Elektrotechnik). 22 Feb 1983. 180p. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number DE84770530.

The aim of the research project was to allocate the energy consumption of a vehicle to concrete operating conditions. The results of extensive investigations in the laboratory and in practical traffic conditions have confirmed that this is possible, though with some limitations (which are explained in detail). The method for determining the energy consumption, as used for conventional road vehicles, is only partially suitable for assessing electric vehicles. The investigation of an actual electric vehicle has confirmed previous experience, that the DC machine together with full electronic controls and a rigid gearbox work very effectively and are far superior to an internal combustion engine. However, the storage of electrical energy by a lead-acid battery is connected with comparatively high losses. As a synthesis of the investigations in the laboratory and on the road, a semi-empirical simulation model of an elec-

tric vehicle using the results found in practice is suitable. This model, consisting of a mathematical technical equivalent circuit diagram of the whole vehicle, makes it possible to assess the energy characteristics in all practical relevant driving conditions.

3306 Vehicle Design Factors

50086 (CONF-8004243—, pp 138-155) **Possibilities to improve the efficiency of power transmission.** Drechsel. 1980. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI84770472.

From Conference on fuel-saving driving systems; Zwickau, German D.R. (17 Apr 1980).

In the case of heavy trucks 62-70% of the energy is used to cover engine losses, 9-19% for compensation of losses in the driving unit and 0,05-2% as wheel creep power. Only 10-30% are left to overcome tractive resistance. Reduction of losses in engine and driving unit can be done within narrow limits only, which means that special attention has to be paid to the reduction of tractive resistance. The connection between tractive resistance power and driving power and the possibilities to influence them are explained by means of formulas. Further details are given on the relative efficiency degree of the power output of the engine, possibilities for fuel saving by adapting the gear transmission ratio are indicated. Fuel consumption can be reduced by the following measures: reduction of tractive resistance, improved adaption of the characteristic diagram of the engine to the requirements of vehicle operation, use of turbocharged engines with close gearbox transmission ratios, planning of the transmission ratio according to minimum fuel consumption.

3307 Emission Control

REFER ALSO TO CITATION(S) 33070050071, 50080, 50081, 50081, 50088, 50332

50087 (NP—4770522) **Theoretical and experimental studies on the limits of capacity of the thermal reactor in aftertreatment of exhaust gases.** Hattingen, U. (Kaiserslautern Univ. (Germany, F.R.). Fachbereich Maschinenwesen). [1984]. 106p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE84770522.

After-treatment of exhaust gases in order to bring about an improvement for air hygiene purposes is largely carried out using precious metal catalysts. Apart from the high cost factor involved in this technology, further disadvantages are the sensitivity towards fuel and lubricant additives and a restriction to the stoichiometric point of operation. By contrast, the thermal reactor is not sensitive towards fuel and lubricant additives and has been successfully used outside the stoichiometric point of operation for the reduction of carbon monoxide and uncombusted hydrocarbon levels. Within the framework of this investigation it was possible to show experimentally that this technology can also be applied to reduce nitrogen oxide emissions provided that the retention time for the exhaust gases in the reactor is extended. For the internal combustion engine the levels of all three pollutants could be reduced through a retention time of less than 10 s. It is questionable, however, whether the required operational temperature for the system studied of approx. 760°C will be available in modern automobile engines.

3308 Alternative Fuels

50088 (CONF-8004243—, pp 94-110) **Liquid gas operation.** Hoche, A. 1980. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI84770472.

From Conference on fuel-saving driving systems; Zwickau, German D.R. (17 Apr 1980).

Both components of liquid gas, propane and butane are produced during the production of fuel from lignite and during crude oil processing. If used as fuel some special features resulting from the physical properties of gas have to be observed. The liquid state needs a certain excess pressure and during transition to the gaseous state one needs to add the necessary evaporation heat. Liquid gas is a very high-quality fuel with a high octane number. Apart from the tank for the liquid a car has to be equipped with a pressure-reduction device, an evaporator and a gas mixer. The fuel tank has to meet certain strength and safety demands (explained in detail). Some examples are given in order to explain the special features and consequences of the use of liquid gas as fuel for cars. A lower specific fuel consumption, lower mechanical stress, longer service life of the vehicle, reduced dirt accumulation, longer oil change periods, smoke-free operation, reduced production of CO, CH and NOsub(x), almost odorless exhaust gas and greater elasticity of combustion engine operation could be proved.

36 MATERIALS

50089 (CONF-8409156—1) **Emerging role of the national laboratory in the development and transfer of materials technology.** Postma, H. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001252.

From 8. biennial conference on national materials policy; Fredericksburg, VA, USA (11 Sep 1984).

The national laboratories are in a unique position to contribute to the overall national effort in materials R and D. The laboratories have the expertise and resources to construct and operate large national facilities for materials research. The laboratories provide a framework for integrating basic research and technology development activities at a common site. Finally, national laboratories play important roles in the development and transfer of materials technologies.

50090 (DOE/ER—0143/2) **Materials Sciences programs, Fiscal Year 1984.** (USDOE Office of Energy Research, Washington, DC. Materials Sciences Div.). Sep 1984. 247p. NTIS, PC A11/MF A01; GPO Dep. File Number DE85001470.

This report provides a convenient compilation and index of the DOE Materials Sciences Division programs. The report is divided into six sections. Section A contains all Laboratory projects, Section B has all contract research projects, Section C has projects funded under the Small Business Innovation Research program, Section D has information on DOE collaborative research centers, Section E gives distributions of funding, and Section F has various indexes.

50091 (INIS-mf—9045) **Proceedings of the 17. scientific meeting, the Weizmann Institute of Science, April 7, 1983.** (Israel Society for Electron Microscopy). 1983. 26p. (CONF-8304197—Summ.). NTIS (US Sales Only), PC A03/MF A01. File Number DE85780034.

From 17. scientific meeting of the Israel Society for Electron Microscopy; Rehovoth, Israel (7 Apr 1983).

Individual items in scope for the data base are processed separately.

50092 (LBL—18027) **Transmission electron microscopy of inorganic materials.** Thomas, G. (Lawrence Berkeley Lab., CA (USA)). Jun 1984. Contract AC03-76SF00098. 52p. (CONF-8408117—1). NTIS, PC A04/MF A01; GPO Dep. File Number DE85000708.

From 3. Asian Pacific conference and workshop on electron microscopy; Singapore, Singapore (24 Aug 1984).

This brief summary attempts to illustrate how the sophisticated methods of electron microscopy and chemical microanalysis can be applied to practical, industrial problems. Since these problems are generic the methods apply equally well to all materials but this review is limited to inorganic materials illustrated with representative examples of research on steels, ceramics and electronic materials.

50093 (ORNL—6084) **Metals and Ceramics Division progress report for period ending June 30, 1984.** Brogden, I. (ed.). (Oak Ridge National Lab., TN (USA)). Sep 1984. Contract AC05-84OR21400. 117p. NTIS, PC A06/MF A01; GPO Dep. File Number DE85001500.

This progress report covers the research and development activities of the Metals and Ceramics Division from January 1, 1983, through June 30, 1984. The format of the report follows the

organizational structure of the division. Short summaries of technical work in progress in the various experimental groups are presented in six parts. Chapter 1 deals with the research and development activities of the Engineering Materials Section, Chapter 2 with the Processing Science and Technology Section, Chapter 3 with the Materials Science Section, Chapter 4 with Project Activities, Chapter 5 with Specialized Research Facilities and Equipment, and Chapter 6 with Miscellaneous Activities.

50094 **(ORNL/FMP—84/3) Advanced Research and Technology Development Fossil Energy Materials Program. Quarterly progress report ending June 30, 1984.** (Oak Ridge National Lab., TN (USA)). Aug 1984. Contract AC05-84OR21400. 507p. NTIS, PC A22/MF A01; 1; GPO Dep. File Number DE85000475.

The objective of the AR and TD Fossil Energy Materials Program is to conduct research and development on materials for fossil energy applications with a focus on the longer-term and generic needs of the various fossil fuel technologies. The program includes research aimed toward a better understanding of materials behavior in fossil energy environments and the development of new materials capable of substantial enhancement of plant operations and reliability. The management of the Program has been decentralized to DOE Oak Ridge Operations Office (ORO) and the Oak Ridge National Laboratory (ORNL) as technical support contractor. A substantial portion of the work on the AR and TD Fossil Energy Materials Program is performed by participating subcontractor organizations. The ORNL Fossil Energy Materials Program Office compiles and issues this combined quarterly progress report from camera-ready copies submitted by each of the participating subcontractor organizations. This report of activities on the program is organized in accordance with a work breakdown structure defined in the AR and TD Fossil Energy Materials Program Plan for FYs 1982 to 1986, in which projects are organized according to fossil energy technologies. It is the intent of the AR and TD Fossil Energy Materials Program to sponsor materials research which is generic to a number of fossil energy technologies. We hope this series of AR and TD Fossil Energy Materials Program quarterly progress reports will aid in the dissemination of information developed on the program.

3601 Metals And Alloys

REFER ALSO TO CITATION(S) 36010049730, 49784, 49809, 49915, 50172, 50243, 50245, 50252, 50329, 50386, 50386, 50590, 50945, 50946

50095 **(CONF-830942—87) Swelling and swelling resistance possibilities of austenitic stainless steels in fusion reactors.** Maziasz, P.J. (Oak Ridge National Lab., TN (USA)). 1983. Contract AC05-84OR21400. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001261.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

Fusion reactor helium generation rates in stainless steels are intermediate to those found in EBR-II and HFIR, and swelling in fusion reactors may differ from the fission swelling behavior. Advanced titanium-modified austenitic stainless steels exhibit much better void swelling resistance than AISI 316 under EBR-II (up to ~ 120 dpa) and HFIR (up to ~ 44 dpa) irradiations. The stability of fine titanium carbide (MC) precipitates plays an important role in void swelling resistance for the cold-worked titanium-modified steels irradiated in EBR-II. Futhermore, increased helium generation in these steels can (a) suppress void conversion, (b) suppress radiation-induced solute segregation (RIS), and (c) stabilize fine MC particles, if sufficient bubble nucleation occurs early in the irradiation. The combined effects of helium-enhanced MC stability and helium-suppressed RIS suggest better void swelling resistance in these steels for fusion service than under EBR-II irradiation.

50096 **(CONF-840417—3) Design of ordered intermetallic alloys for high-temperature structural use.** Liu, C.T. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 20p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000897.

From High-temperature alloys - theory and design conference; Bethesda, MD, USA (8 Apr 1984).

Many ordered intermetallic alloys possess attractive high-temperature properties; however, low ductility and brittle fracture restrict their use for structural applications. This paper summarizes the current work on alloy design of ordered intermetallics based on the Ni_3V-Co_3V-Fe_3V and Ni_3Al systems. Both macroalloying and microalloying were used to improve the ductility and fabricability of these alloys. Macroalloying is aimed at controlling ordered crystal sructures and properties in $(Ni,Co,Fe)_3V$ alloys, whereas microalloying is directed toward alleviating both intrinsic and extrinsic grain-boundary weakness in nickel aluminides based on Ni_3Al. Success in development of these ductile intermetallics is discussed, with emphasis on metallurgical principles involved in the alloy design.

50097 **(CONF-840417—6) Alloying effects and microstructure of iron aluminides.** Horton, J.A.; Liu, C.T.; Koch, C.C. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 13p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000903.

From High-temperature alloys - theory and design conference; Bethesda, MD, USA (8 Apr 1984).

An alloying study of the iron aluminide, Fe_3Al, with ternary additions of boron, silicon, copper, or nickel has been performed in order to investigate their alloying behavior and associated microstructures. It was found that additions of boron had virtually no effect on the ductility and fracture behavior of Fe_3Al. Although silicon and copper increased the yield stress and hardness both elements were found to embrittle the alloy by a process of second phase precipitation. Second-phase particles were observed only on grain boundaries in the silicon alloys with ≧ 3 at. % Si, but these precipitates were almost silicon free. Copper additions resulted in extensive precipitation throughout the matrix and on grain boundaries except for a precipitate-free zone adjacent to the grain boundaries. Nickel additions also resulted in grain boundary fracture in two-phase alloys except for the alloy of the composition 40 at. % Fe-40Ni-20Al. This alloy has improved high-temperature strength as well as room-temperature ductility.

50098 **(CONF-840604—23) Experimental determination of the critical cavity radius in Fe-10% Cr for ion irradiation.** Horton, L.L.; Mansur, L.K. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 30p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85001247.

From 12. international symposium on effects of radiation on materials; Williamsburg, VA, USA (18 Jun 1984).

An ion bombardment experiment was designed to investigate the minimum critical radius, r/sub c/sup c*/, for the ferritic alloy Fe-10% Cr. Specimens were implanted with 300 appM Helium, annealed, and then irradiated to 30 dpa at 850K with 4-MeV Fe^{2+} ions. The specimens contained a bimodal cavity distribution consisting of a population of larger cavities (average radius 7.6 nm) and a population of smaller cavities (average radius 1.2 nm). The upper cut-off of the cavity radii for the smaller cavities, 2.5 nm, is interpreted as r/sub c/sup c*/. Theoretical calculations of r/sub c/sup c*/ for physically allowable combinations of bias, surface energy, vacancy migration energy, and vacancy formation energy and entropy were performed using the measured minimum critical radius and microstructural data. Thus, an indirect determination of these fundamental parameters was made for this alloy. The results suggest that a bias of ~ 0.2 is reasonable. An assessment of the possible values of the other fundamental parameters is given. In addition, the low irradiation-induced dislocation density ($1 \times 10^{13} m^{-2}$), which results in the ratio of the dislocation and cavity sink strengths, Q, being much less than unity, may be partially responsible for the low cavity growth rate in this alloy.

50099 **(CONF-840760—13-Rev.) Morphological instabilities and ion beam mixing in Ge. Revision.** Appleton, B.R.; Holland, O.W.; Poker, D.B.; Narayan, J.; Fathy, D. (Oak Ridge National Lab., TN (USA); North Carolina State Univ., Raleigh (USA)). 10 Sep 1984. Contract AC05-84OR21400. 20p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001858.

From Ion beam modification of materials conference; Ithaca, NY, USA (16 Jul 1984).

In light of the recent discovery that heavy ion irradiation initiates a morphological instability in the amorphous phase of Ge which erupts to form surface craters, previous studies of ion beam mixing in the metal/Ge system are re-examined. Correlated ion scattering/channeling and cross-section electron microscopy are utilized to study the Au/Ge and Al/Ge systems under a variety of mixing conditions. Implications for both the crater formation and ion beam mixing mechanisms are discussed.

50100 **(CONF-840767—6) Application of extraction replicas and analytical electron microscopy to precipitate phase studies.** Kenik, E.A.; Maziasz, P.J. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001253.

From Microbeam Analysis Society analytical electron microscopy meeting; Bethlehem, PA, USA (19 Jul 1984).

Extraction replicas provide a powerful extension of AEM techniques for analysis of fine precipitates. In many cases, replicas allow more accurate analyses to be performed and, in some cases, allow unique analyses which cannot be performed in-foil. However, there are limitations to the use of extraction replicas in AEM, of which the analyst must be aware. Many can be eliminated by careful preparation. Often, combined AEM studies of precipitates in-foil and on extraction replicas provide complementary and corroborative information for the fullest analysis of precipitate phases.

50101 **(CONF-841157—4) Radiation-induced compositional redistribution and local phase transformation in irradiated alloys.** Lam, N.Q.; Okamoto, P.R. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 4p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000080.

From Symposium on the scientific basis for nuclear waste management; Boston, MA, USA (26 Nov 1984).

In order for radioinduced segregation to occur, certain alloy elements need to be coupled to radioinduced defect fluxes. Some observations of local phase changes in Ni-based alloys during ion bombardment and high-voltage electron-microscopic irradiation are reported in this paper. (DLC)

50102 **(CONF-8409102—4) Magnetism of californium metal.** Nave, S.E.; Moore, J.R.; Spaar, M.T.; Haire, R.G.; Huray, P.G. (Tennessee Univ., Knoxville (USA). Dept. of Physics; Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400;AS05-79ER10348. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001141.

From EPS topical conference on electronic structure and properties of rare earth and actinide intermetallics; St. Polten, Austria (3 Sep 1984).

Magnetic susceptibility measurements have been made on samples of californium-249 metal having the dhcp crystal structure. At temperatures between 100K and 300K and at fields up to 50 kilogauss, the samples exhibit Curie-Weiss behavior with 3 samples giving a magnetic moment per atom of μ/sub eff/ = 10.6 +- 0.2 μ/sub B/ and paramagnetic Weiss temperatures, θ/sub p/, in the range of -2K to -41K. These values of μ/sub eff/ are in good agreement with the value expected (10.62μ/sub B/) for a free-ion $5f^9$ configuration based on an L-S coupling scheme and Hund's Rule. A fourth sample gives the values μ/sub eff/ = 9.7 +- 0.2μ/sub B/ and θ/sub p/ = -41K. At low temperatures the samples exhibit an ordered magnetic transition to a state with a saturated moment of 6.1 μ/sub B//atom when extrapolated to infinitely-high field. The low temperature ordered phase exists at temperatures below T/sub c/ = 51 +- 2K as determined from constant magnetization plots. 2 references, 3 figures.

50103 **(CONF-8409103—3) SANS and TEM studies of carbide precipitation and creep damage in type 304 stainless steel.** Yoo, M.H.; Ogle, J.C.; Schneibel, J.H.; Swindeman, R.W. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000933.

From 5. Riso international symposium on metallurgy and materials science; Roskilde, Denmark (1 Sep 1984).

Small-angle neutron scattering (SANS) and transmission electron microscopy (TEM) studies were performed to characterize the carbide ($M_{23}C_6$) precipitation and creep damage induced in type 304 stainless steel in the primary creep stage. The size distribution of matrix carbides evaluated from SANS analyses was consistent with TEM data, and the expected accelerated kinetics of precipitation under applied stress was confirmed. Additional SANS measurements after the postcreep solution annealing were made in order to differentiate cavities from the carbides. Potential advantages and difficulties associated with characterization of creep-induced cavitation by the SANS techniques are discussed.

50104 **(CONF-8409107—6) Microstructure of rapidly quenched type 308 stainless steel weld filler metal and its implications on rapid solidification processes.** David, S.A.; Vitek, J.M. (Oak Ridge National Lab., TN (USA)). 7 Sep 1984. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000930.

From 5. international conference on rapidly-quenced metals; Wurzburg, F.R. Germany (3 Sep 1984).

The structure of type 308 stainless steel was evaluated following rapid quenching using the hammer-arc process. A large degree of variation was found from a fully austenitic structure to the duplex ferrite plus austenite structure commonly found in welded material. The lack of large-scale segregation, as determined by electron microprobe analysis, indicates the structural variations are due to cooling rate changes rather than compositional fluctuations. The results also show that this material is very sensitive to cooling rate in the range prevalent in the hammer-arc process.

50105 **(CONF-8409130—5) Fundamental aspects on ion-beam surface modification: defect production and migration processes.** Rehn, L.E.; Averback, R.S.; Okamoto, P.R. (Argonne National Lab., IL (USA)). Sep 1984. Contract W-31-109-ENG-38. 31p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85000093.

From International conference on surface modification of metals by ion beams; Heidelberg, F.R. Germany (17 Sep 1984).

Ion-beam modification of metals is generating increasing scientific interest not only because it has exciting technological potential, but also because it has raised fundamental questions concerning radiation-induced diffusion processes. In addition to the implanted species, several defect production and migration mechanisms contribute to changes in the near-surface composition of an alloy during ion bombardment, e.g., atoms exchange positions via displacements and replacement sequences; preferential sputtering effects arise; radiation-enhanced diffusion and radiation-induced segregation occur. The latter two defect migration mechanisms are of particular significance since they can alter the composition to depths which are much greater than the implanted ion range. By altering various parameters such as irradiation temperature, ion mass, energy, and current density, and initial alloying distributions, a rich variety of near-surface composition profiles can be created. We have utilized changes in ion mass and energy, and irradiation temperature to distinguish defect production from defect migration effects. Experimental results are presented which provide a guide to the relative efficiencies of different mechanisms under various irradiation conditions. 46 references.

50106 **(CONF-8409142—1) Role of boron additions on grain-boundary chemistry and tensile properties of Ni_3Al containing 24 and 26 at. % Al.** Liu, C.T.; White, C.L.; Horton, J.A. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 61p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85001264.

From ECUT workshop on production and fabrication of ordered intermetallic alloys; Oak Ridge, TN, USA (25 Sep 1984).

Effects of up to 0.4 wt % B in Ni_3Al containing 24 to 26 at. % Al were studied. Room-temperature ductility and fracture behavior of B-doped Ni_3Al depend critically on deviation from alloy stoichiometry. As the Al content of B-doped Ni_3Al is decreased below 25 at. %, the ductility increases dramatically and the fracture mode changes from intergranular to transgranular. Auger studies indicate that the intensity of boron segregated to grain boundaries increases and the concentration of grain-boundary Al decreases significantly with decreasing bulk Al concentration. These results suggest that alloy stoichiometry strongly influences grain-boundary chemistry, which, in turn, affects the grain-boundary cohesion.

Boron exhibits an unusual segregation behavior in Ni_3Al, i.e., it has a strong tendency to segregate to the grain boundaries but not to cavity (free) surfaces. On the other hand, sulfur, an embrittling impurity, tends to segregate more strongly to free surfaces than to grain boundaries. The beneficial effect of boron is in agreement with existing theories of solute segregation effects on grain-boundary cohesion. The yield stress of B-doped Ni_3Al decreases with increasing grain size produced by long-term annealing at 1000°C. The yield stress obeys the Hall-Petch relation: $\sigma_{y} = \sigma_{o,y} + k_{y} d^{-1/2}$ with $\sigma_{o,y} = 163$ MPa and $k_{y} = 8.2$ MPa cm$^{1/2}$. The tensile elongation was initially independent of grain size, and showed only a moderate decrease from about 50 to 40% with grain diameters larger than 110 μm.

50107 (CONF-8409154—1) Boron-induced toughness loss in Ti-6A1-2Nb-1Ta-0.8Mo. Inouye, H.; David, S.A. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000932.

From 5. international conference on titanium; Muenich, F.R. Germany (10 Sep 1984).

Because boron has been added to the weld filler metal to refine the weld grain structure and is a common impurity in Al, the poor weld and HAZ properties of the Al-stabilized alloys could have been caused by this B. This thermal cycling study showed that the precipitated phase was Ti B and the the B raised the B-transus. The phase relation of B in Ti6211 permits a plausible explanation for the toughness loss of α + B annealed alloys caused by welding and weld thermal cycles. The alloys with B contents under this solubility limit of 0.0018% B were unaffected. (DLC)

50108 (DOE/ER/10429—T3) Atomistic studies of grain boundaries with segregated impurities. Final progress report, July 1983-June 30, 1984. Vitek, V. (Pennsylvania Univ., Philadelphia (USA). Dept. of Materials Science and Engineering). Jan 1984. Contract AC02-79ER10429. 22p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000063.

The empirical scheme of construction of interatomic potentials for pure metals and substitutional binary alloys has been extended to a much wider class of metals. This enabled us to construct potentials for Fe-Cu system and potentials for Fe-Sn and Fe-Sb are being developed. Atomistic studies of the grain boundaries with impurities have been made for Cu-Bi, Cu-Ag, Ag-Au and Au-Ag systems. Segregation was found to occur in the three former alloys but not in the latter. A saturation of the segregant was found beyond which no further segregation can occur. In the case of Cu-Bi this corresponds to about 1.25 monolayer, in very good agreement with experimental data. In general, transformations of the structure are invoked by segregation and their extent depends on the alloy system. They are most pronounced in the Cu-Bi system. Studies of the trapping of H and He by the grain boundaries in Ni show that H is not very effectively trapped by the boundaries and thus it is unlikely to segregate.

50109 (DOE/ET/10577—T3) Hot corrosivity of coal conversion product on high temperature alloys. Final report. Meier, G.H. (Pittsburgh Univ., PA (USA). Dept. of Metallurgical and Materials Engineering). 29 Aug 1984. Contract AS01-76ET10577. 18p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84017248.

This report describes research begun under Contract AS01-76-ET-10577, most of which was continued when the same project was continued under a new number, Contract AC01-79-ET-13547. The areas studied are thermochemistry of high temperature corrosion, hot corrosion of turbine alloys and coatings, and electrochemistry of sulfate melts. A background to the problem of hot corrosion is presented first followed by a description of results obtained in the three areas of this project.

50110 (DOE/SF/00115—T11) Structural studies of amorphous Mo-Ge alloys using synchrotron radiation. Kortright, J.B. (Stanford Univ., CA (USA). Stanford Synchrotron Radiation Lab.). Jun 1984. Contract AM03-76SF00115. 249p. (SSRL—84/05). NTIS, PC A11/MF A01; 1; GPO Dep. File Number DE85002061.

Structural changes in sputtered amorphous Mo-Ge alloy films with composition varying from a-Ge to about 70 at. % Mo have been studied with several x-ray techniques. Results of individual techniques are presented and discussed in separate chapters. The complementary nature of information obtained from EXAFS and scattering for these materials is discussed in a separate chapter. A concluding chapter summarizes the results and structural changes with composition.

50111 (GKSS—84/E/15) Treatment of material laws for approximate J-estimation methods. Cornec, A.; Seeger, T. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1984. 26p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85750068.

In order to estimate the load and elastic-plastic deformation behaviour of cracked structures methods are necessary to take into account the influence of arbitrarily shaped real material laws on the J-integral and displacement behaviour, at least in an approximate form in the sense of an engineering approach. Such methods are generated and discussed in this paper. They are based on the well known formulae in the EPRI-Handbook which are valid only for specific power laws. An extensive study has been carried out using idealised material laws with two distinct strain-hardening regions. The influence on J has been evaluated by a systematic variation of the parameters of these idealised material laws in an unambiguous way. The work described in the paper was carried out of the Technical University of Darmstadt.

50112 (GKSS—84/E/17) Measurement and calculation of the three-dimensional instationary temperature field in underwater welded plates. Noack, H. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.); Hochschule der Bundeswehr, Hamburg (Germany, F.R.). Fachbereich Maschinenbau). 1984. 224p. (In German). NTIS (US Sales Only), PC A10/MF A01. File Number DE85750069.

The three dimensional instationary temperature field in under water wet welded steel plates has been calculated using a simple finite element model. Deposition welds on plates of different thickness welded with flux covered electrodes have been simulated. To check the numerical results temperature measurements have been carried out. The influence of the slag on the temperature field has been estimated and the effect of thermal insulations has been demonstrated. Finally the approach of the temperature field to the quasistationary state depending on plate thickness and thermal insulations has been investigated.

50113 (IA—1386, pp 99) NMR study of hydrogen in cathodically charged inconel 718. Raizman, A.; Barak, J.; Zamir, D. (Israel Atomic Energy Commission, Tel Aviv); Eliezer, D. (Ben-Gurion Univ. of the Negev, Beersheba (Israel)). Jul 1983. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780540.

In Research laboratories annual report 1982.

50114 (IA—1386, pp 102-104) Neutron diffraction study of the tetragonal $NpCu_4Al_8$ and $ErFe_4Al_8$ intermetallic compounds. Pinto, H.; Gal, J.; Melamud, M.; Shaked, H. (Israel Atomic Energy Commission, Tel Aviv); Cacciuffo, R. (Institut Max von Laue - Paul Langevin, 38 - Grenoble (France)); Potzel, W.; Kalvius, G.H. (Technische Univ. Muenchen, Garching (Germany, F.R.)). Jul 1983. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780540.

In Research laboratories annual report 1982.

50115 (INIS-mf—8881, pp vp) State of the development and applications-techniques of the steel X 20 CrMoV 12 1. Kalwa, G. (Mannesmann-Forschungsinstitut G.m.b.H., Duisburg (Germany, F.R.)). 1983. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84780610. (CONF-8310224—).

From MPA seminar on safety of light water reactor pressure vessels; Stuttgart, F.R. Germany (13 Oct 1983).

Martensitic X 20 Cr Mo V 121 steel, used in most European and many other countries for the parts of conventional power stations, such as superheater tubes and live steam pipes must be

stressed by temperature and pressure. One can design pipes with considerably thinner walls, and which are more flexible using this steel than using lower alloyed steels. Compared to pipework systems with thick walls, operation using this plant has the additional advantage of making use of higher starting up speeds. The X 20 Cr Mo V 121 steel forms the necessary link in the range of heat resistant steels between low alloyed ferritic-bainitic and highly alloyed Austenitic steels. The great long term strength of this steel can only be achieved by 12% chromium content and the addition of molybdenum and vanadium. One must consider the great hardness of the Martensite formed during heat treatment and welding of this steel in machining.

50116 (INIS-mf—8881, pp vp) **Manufacturing of ultra-large diameter 20 MnMoNi 5 5 steel forgings for reactor pressure vessels and their properties.** Onodera, S. (Japan Steel Works Ltd., Tokyo); Kawaguchi, S. (Japan Steel Works Ltd., Muroran, Hokkaido. Muroran Plant); Tsukada, H.; Moritani, H. (Japan Steel Works Ltd., Muroran, Hokkaido. Forging Dept.); Suzuki, K.; Sato, I. (Japan Steel Works Ltd., Muroran, Hokkaido. Atomic Energy Dept.). 1983. NTIS (US Sales Only), PC A22/MF A01. File Number TI84780610. (CONF-8310224—).

From MPA seminar on safety of light water reactor pressure vessels; Stuttgart, F.R. Germany (13 Oct 1983).

A set of component material for PHWR RPV, including the largest forgings ever manufacture so far such as flanges (8,440 mm O.D.), shells and torus (7,960 mm O.D.) and dome (6,800 mm dia. in chord, 460 mm thick), was presented in the outline of manufacturing and properties. Even with increased dimensions and weight than the current largest forgings, the manufacture and the qualities achieved were satisfactory. These results encourage us in further developing PWRs and PHWRs with increased capacity.

50117 (INIS-mf—8881, pp vp) **Proof of the fracture resistance of the pipes in the THTR 300 plant using high temperature burst tests with X 20 CrMoV 12 1 components.** Bernecker, G.; Gnirss, G. (Brown, Boveri und Cie A.G., Mannheim (Germany, F.R.)); Schulze, H.D. (Rheinisch-Westfaelischer Technischer Ueberwachungs-Verein e.V., Essen (Germany, F.R.)); Julisch, P. 1983. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84780610. (CONF-8310224—).

From MPA seminar on safety of light water reactor pressure vessels; Stuttgart, F.R. Germany (13 Oct 1983).

A sufficient safety factor between possible cracks occurring in components and the critical crack length was proved by fracture mechanics. These calculations were experimentally confirmed by pipe burst tests in conditions similar to those of the THTR 300 for X20 Cr Mo V 121 in the start of life state. The experiments showed that longitudinal notches of the pipe diameter with a depth of 90% of the wall thicknes in the longitudinal pipe direction in the basic material and in the circumferential direction in weld material fulfill the leak before fracture criterion. The supporting load behaviour of the experimental bodies is conservatively described in the technically interesting area by the fracture mechanics failure concepts with the exception of plastic instability.

50118 (INIS-mf—8881, pp vp) **Toughness behaviour of the steel X 20 CrMoV 12 1. Results of optimizing the base- and weld metal.** Tolksdorf, E.; Schneider, K.; Gruenling, H.W. (Brown, Boveri und Cie A.G., Mannheim (Germany, F.R.). Zentralstelle fuer Werkstoff-Technik). 1983. NTIS (US Sales Only), PC A22/MF A01. File Number TI84780610. (CONF-8310224—).

From MPA seminar on safety of light water reactor pressure vessels; Stuttgart, F.R. Germany (13 Oct 1983).

This paper presents the results of ageing treatments at 550°C, carried out with a 12% Cr steel (DIN X 20 Cr Mo V 12 1) specifically optimized for toughness. The decrease in toughness is already evident at ageing times as low as 1000h for conventional and optimized material. This drop in toughness is tentatively explained by differences in grain sizes, and carbide content.

50119 (INIS-mf—8881, pp vp) **Significance of the state of segregation of the carbide phase on the toughness properties of 20 MnMoNi 5 5 forgings.** Forch, K.; Piehl, K.H.; Witte, W. (Thyssen Henrichshuette A.G., Hattingen (Germany, F.R.)). 1983. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84780610. (CONF-8310224—).

From MPA seminar on safety of light water reactor pressure vessels; Stuttgart, F.R. Germany (13 Oct 1983).

When measured in the heat treated wall thickness of heavy forgings, 20 Mn Mo Ni 5 5 steel is so low in alloy that it is unavoidable that large parts of higher bainite will occur in the structure of the pieces. In order to obtain the best possible notch impact strength values, tempering is of particular importance. It must be done so that there is the least possible segregation of molybdenum carbide Mo_2C in the bainite ferrite. This requires the use of not too high tempering temperatures together with an upper limit of tempering time. Similar considerations apply for stress relieving treatment.

50120 (INIS-mf—8881, pp vp) **Influence of loading rate on the fracture toughness vs. temperature curve.** Hesse, W.; Dahl, W. (Technische Hochschule Aachen (Germany, F.R.). Lehrstuhl und Inst. fuer Eisenhuettenkunde). 1983. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84780610. (CONF-8310224—).

From MPA seminar on safety of light water reactor pressure vessels; Stuttgart, F.R. Germany (13 Oct 1983).

Correlations were checked and prepared from the experimental results of displacing the quasi-static transition temperature Tsub(UKIc) to higher temperatures under dynamic stress, which describe the displacement using the flow behaviour of steel as a function of temperature and rate of strain.

50121 (INIS-mf—8881, pp vp) **Energy transformation during dynamic crack initiation and arrest.** Zimmermann, C.; Demler, T.; Tomoda, Y.; Roos, E. (Stuttgart Univ. (Germany, F.R.). Staatliche Materialpruefungsanstalt). 1983. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84780610. (CONF-8310224—).

From MPA seminar on safety of light water reactor pressure vessels; Stuttgart, F.R. Germany (13 Oct 1983).

One can summarise the results of investigations in the areas of dynamic crack initiation, dynamic spreading and arrest of cracks for the steels examined as follows: 1. Coefficients for dynamic initiation can be determined by instrumentation of samples with DMS in the above mentioned way. 2. The experimental technique and the theoretical basis for determining the energy transformation for fast cracks in small samples are not yet developed for these steels. 3. Regardless of the crack arrest concept used, the arrest toughnesses found in the stated experimental conditions are not characteristics of the material.

50122 (INIS-mf—8881, pp vp) **Evaluation of the weldability of heavy-section forgings with special emphasis of segregated areas.** Schmidt, T.; Breckwoldt, E.; Loehberg, R. (Kraftwerk Union A.G., Erlangen (Germany, F.R.)). 1983. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84780610. (CONF-8310224—).

From MPA seminar on safety of light water reactor pressure vessels; Stuttgart, F.R. Germany (13 Oct 1983).

This is a report on comparative examination of components, large plates and implants for assessing the weldability of 20 Mn Mo Ni 5 5 material. The result is that success was obtained in assessing the sensitivity to cold cracking by this process. However, the experimental welding of large plates gave different absolute information on the minimum preheating temperature. This is explained.

50123 (INIS-SU—247, pp 194-197) **Investigation of intermediate mass ion implantation in bismuth.** Plashchinskij, G.I.; Tashlykov, I.S. 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. File Number TI84780555. (CONF-8205270—).

From 12. All-Union conference on physics of interaction between charged particles and crystals; Moscow, USSR (25 May 1982).

By the method of Rutherford backscattering of 1.4 MeV gallium ions in combination with channeling, the degree of damage of Bi monocrystals with its irradiation with the 60 keV chlorine ions and 30 keV nitrogen ions is investigated. The dose of introduced ions is 10^{16} cm^{-2}. It is shown that Bi surfaces possess a gettering ability not only to defects but to additions as well. The greatest oxygen geterring (by 2.5 times) is observed in the case of Cl implantation as compared with N introduction. In the case of implantation in the bismUth film of N ions, nitrogen gettering from atmosphere is stronger than in the case of chlorine introduction.

50124 (INIS-SU—247, pp 34-39) **Dependence of characteristic X-radiation emission effective depth from type of dechanneling differential function.** Burenkov, A.F.; Kosse, A.I.; Puzanov, A.A.; Urmanov, A.P. 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. File Number TI84780555. (CONF-8205270—).

From 12. All-Union conference on physics of interaction between charged particles and crystals; Moscow, USSR (25 May 1982).

An attempt is made to explain local extrema on dependence curve of intensity ratio Lsub(α) and Lsub(β) of lines of characteristic X-radiation CXR) of tungsten atoms from the angle between the direction of proton incidence (with the initial energy of 600 keV) on tungsten monocrystal and the chosen crystallographic direction. To describe the CXR yield, a standard model is chosen: dechanneled particles move in the non-oriented direction approximately at the same angle to the normal to the target surface, as channeled protons. It is shown that the peculiarity in the dynamics of the form of dechanneling function is conditioned by its sensitivity to the initial energy distribution of the particle transverse motion.

50125 (INIS-SU—247, pp 71-74) **Thermal vibration effects in diffusion model calculations of blocking dips.** Fuschini, E.; Ugozzoni, A. 1983. NTIS (US Sales Only), PC A11/MF A01. File Number TI84780555. (CONF-8205270—).

From 12. All-Union conference on physics of interaction between charged particles and crystals; Moscow, USSR (25 May 1982).

In the framework of the diffusion model, a method for calculating blocking dips is suggested that takes into account thermal vibrations of the crystal lattice. Results of calculations of the diffusion factor and the transverse energy distribution taking into account scattering of the channeled particles at thermal vibrations of lattice nuclei, are presented. Calculations are performed for α-particles with the energy of 2.12 MeV at 300 K scattered by Al crystal. It is shown that calculations performed according to the above method prove the necessity of taking into account effects of multiple scattering under blocking conditions.

50126 (INIS-SU—247, pp 176-179) **Energy-dispersion X-ray analysis for investigation of structural transformations in crystals at ion implantation.** Vasil'ev, V.K.; Gorshkov, O.N.; Novozhilov, V.N. 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. File Number TI84780555. (CONF-8205270—).

From 12. All-Union conference on physics of interaction between charged particles and crystals; Moscow, USSR (25 May 1982).

An experimental device completed by two independent methods that permit to control elementary composition and structure of mono- and polycrystalline solid bodies in the process of ion doping is described. To investigate monocrystalline objects, orientation dependence of the yield of characteristic X-ray radiation excited by ions introducing into the target is used. To study structural changes of mono- and polycrystalline objects, X-ray energy dispersion diffraction analysis is suggested. The equipment realization of the second method and possibilities of its use for the analysis of implanted layers are given. The above technique permits to analyze structural alterations of implanted layers under irradiation.

50127 (INIS-SU—247, pp 90-93) **Simulation of nuclear reaction duration on measurement at substantial radiation damage of monocrystal.** Bugrov, V.N.; Karamyan, S.A. 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. File Number TI84780555. (CONF-8205270—).

From 12. All-Union conference on physics of interaction between charged particles and crystals; Moscow, USSR (25 May 1982).

The shadow effect for elastic scattering of 24 MeV ^{40}Ar ions on tungsten monocrystal, is studied. Quantitative data on the ^{40}Ar ion damaging effect on W monocrystal are obtained. Simulation is performed of conditions of the experiment on measuring nuclear lifetime for testing methodical factors and radiation damage effects on the measurements data. The simulation experiment shows the absence of methodic background contribution in the nuclear reaction duration measured by the shadow method.

50128 (INIS-SU—247, pp 173-175) **Structural transformations in nickel films bombarded by phosphorus and neon ions.** Pavlov, P.V.; Tetel'baum, D.I.; Kuril'chik, E.V.; Romanov, I.G.; Ovsetsina, A.Eh. 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. File Number TI84780555. (CONF-8205270—).

From 12. All-Union conference on physics of interaction between charged particles and crystals; Moscow, USSR (25 May 1982).

Results of investigations of phase structural transitions in nickel films subjected to bombardment with phosphorus and neon, ions, are discussed. It is shown that when irradiating nickel films with P^+ ions with the dose of $6x10^{16}$ ion/cm^2, complete transition of f.c.c.-Ni in the h.c.p.-phase takes place. The formation of this phase is specific radiation factor, such as excitation of electron subsystem, accUmulation of radiation defects etc. The role of phosphorus atoms is in the fact that creating elastic stresses, they contribute to fixation and consequently accumulation of radiation defects.

50129 (KFK—3615) **Advanced superconducting materials.** Fluekiger, R. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Technische Physik). Nov 1983. 10p. (CONF-830971—9). NTIS (US Sales Only), PC A02/MF A01. File Number DE84751515.

From 8. international conference on magnet technology and exhibition; Grenoble, France (5 Sep 1983).

The superconducting properties of various materials are reviewed in view of their use in high field magnets. The critical current densities above 12 T of conductors based on NbN or $PbMo_6S_8$ are compared to those of the most advanced practical conductors based on alloyed by Nb_3Sn. Different aspects of the mechanical reinforcement of high field conductors, rendered necessary by the strong Lorentz forces (e.g. in fusion magnets), are discussed.

50130 (KFK—3670, pp 141-170) **Effect of cyclic thermal shock loading on crack growth behavior.** Stamm, H.; Czuck, G. Feb 1984. (In German). NTIS (US Sales Only), PC A12/MF A01. File Number TI84751925. (CONF-8311169—).

From Annual colloquium of the nuclear safety project; Karlsruhe, F.R. Germany (21 Nov 1983).

Experimental and theoretical of fatigue crack growth under cyclic thermal shock loading are presented. The experiments are performed by cooling hot steel plates with a water jet. Fatigue crack growth is predicted by means of linear elastic fracture mechanics. The single steps of the calculations are discussed and the results are compared with experimental data. The influence of overelastic loading on crack growth in the shakedown-region is shown for a simplified thermal load case.

50131 (KFKI—1983-111) **Neutron diffraction experiments on amorphous alloys.** Svab, E.; Ishmaev, S.N. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Nov 1983. 33p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84703105.

Conventional and time-of-flight neutron diffraction methods were combined to obtain the structure factor for amorphous alloys in a wide scattering vector range leading to high resolution in r-

space. Details of the double-axis and TOF neutron diffractometers, the Fourier transformation and data processing procedures and experimental results obtained for $Ni_{60}Nb_{40}$, $Fe_{81}B_{19}$ and $(Ni_{45}Fe_{55})_{77}B_{23}$ metallic glasses are given.

50132 (LA-UR—84-3001) Actinides: from heavy fermions to plutonium metallurgy. Smith, J.L.; Fisk, Z.; Hecker, S.S. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 23p. (CONF-8409102—5). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002032.

From EPS topical conference on electronic structure and properties of rare earth and actinide intermetallics; St. Polten, Austria (3 Sep 1984).

The actinide elements mark the emergence of 5f electrons. The f electrons possess sufficiently unusual characteristics that their participation in atomic binding often result in dramatic changes in properties. This provides an excellent opportunity to study the question of localization of electrons; a question that is paramount in predicting the physical and chemical properties of d and f electron transition metals. The transition region between localized (magnetic) and itinerant (often superconducting) behavior provides for many interesting phenomena such as structural instabilities (polymorphism), spin fluctuations, mixed valences, charge density waves, exceptional catalytic activity and hydrogen storage. This region offers most interesting behavior such as that exhibited by the actinide compounds UBe_{13} and UPt_3. Both compounds are heavy-fermion superconductors in which both magnetic and superconducting behavior exist in the same electrons. The consequences of f-electron bonding (which appears greatest at Plutonium) show dramatic effects on phase stability, alloying behavior, phase transformations and mechanical behavior.

50133 (LBL—18292) Calorimetric investigation into the possibility of a charge density wave ground state in alkali metals. Van Curen, J. (Lawrence Berkeley Lab., CA (USA)). Aug 1984. Contract AC03-76SF00098. 196p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE85002006.

The heat capacities of potassium, rubidium, and cesium were measured in this apparatus down to 0.15°K. Anomalous features measuring a maximum of 1 to 5% were observed in the low temperature heat capacities of the samples. The maximum contributions occurred at 0.38°K in cesium, 0.55°K in rubidium, and 0.8°K in potassium. The temperature dependences of these features could be fit resonably well by a phason heat capacity. If the details of the phonon spectrum were unknown, this would lead to the conclusion that the alkali metal have a CDW ground state. On the other hand, a comparison of the results with a theoretical prediction for the phonon heat capacity based on a normal plane wave (PW) ground state suggests that these features, at least in potassium and rubidium, arise from complexities in the phonon vibrational spectrum. Thus it seems that potassium and rubidium are best described as having normal PW ground states. In contrast, the results for cesium agree best with the CDW model but the greater difficulty of calculating the normal phonon heat capacity leaves some doubt about this conclusion. In addition to the low temperature feature in the heat capacity, the rubidium sample displayed thermal history dependence in its heat capacity and under certain conditions spontaneously emitted heat. These effects lead us to suspect a martensitic transformation at low temperatures.

50134 (NP—4770519) Phase equilibria in aluminium-lithium-magnesium alloys at 200°C, 300°C and 400°C and their hardening in a casting state. Geissler, I. (Technische Univ. Clausthal, Clausthal-Zellerfeld (Germany, F.R.). Fakultaet fuer Bergbau, Huettenwesen und Maschinenwesen). 19 Mar 1979. 97p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE84770519.

The aim of this research was initially to re-examine the three boundary systems Al-Li, Al-Mg and Mg-Li in the solid phase at 200°C, 300°C and 400°C by means of structural evaluation, electron microscopic analysis (EMA) and dilatometry, and then, based on this, to examine the ternary system Al-Li-Mg at the same temperatures. This objective led to a division of work into the following four sections: 1) Test methods and development of a suitable melting aggregate for Al-Li-Mg alloys; 2) Phase equilibria of the solid state in the aluminium- or magnesium-rich part of the systems Al-Li and Mg-Li; 3) Phase equilibria of the solid state in the system Al-Mg; and 4) Phase equilibria of the solid state in the ternary system Al-Li-Mg and the course of hardening of the ternary cast alloys.

50135 (NP—4770520) Development of a melting apparatus for lithium-containig magnesium-aluminium alloys and its application in thermal analysis. Voss, H.J. (Technische Univ. Clausthal, Clausthal-Zellerfeld (Germany, F.R.). Fakultaet fuer Bergbau, Huettenwesen und Maschinenwesen). 13 Jul 1979. 91p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE84770520.

The aim of these studies was to develop a melting apparatus which permitted on the one hand loss-free melting of lithium-containing magnesium-aluminium alloys, even up to high lithium levels, and on the other a simultaneous study on the state of equilibrium between melt and crystal of these alloys. This renders the experimental conditions more difficult since samples have to be kept in liquid form for many hours without oxidizing or nitrifying. Evidence for the proper functioning of the apparatus was given by the provision of the complete melt equilibria in the ternary system magnesium-lithium-aluminium and its binary boundary systems using thermal analysis, isothermal studies, electron probe microanalysis and raster electron microscopy. In addition the curves of state obtained experimentally were critically compared with those in the literature.

50136 (NP—4770526) Static and dynamic strength of gas turbine blade material under conditions of high temperature corrosion. Demus, H. (Technische Hochschule Darmstadt (Germany, F.R.). Fachbereich Maschinenbau). 8 Dec 1982. 146p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE84770526.

Two hot gas testing units each with 8 test rigs were developed and constructed in which stability and tensile swelling studies could be carried out under hot gas flow. Stability tests on round and flat samples of the materials In-738 (LC), In-939 and FSX 414 for industrial turbine blades and the materials In-713 LC and In-100 for aviation turbine blades were carried out under the following conditions: under stationary air, under hot gas generated by the combustion of aviation fuel TP4 with and without additions of synthesized seasalt, and under hot gas generated by combustion of the heating oil EL with marginally elevated proportions of S, Na, V and Cl. The essential outcome of these tests was that no decrease in stability could be detected up to 2000 hr maximum load duration at 700°C testing temperature, 5000 hr at 800°C and 2000 hr at 900°C if an increase in load through local cross-section losses caused by hot gas corrosion was approximated. This result was confirmed by additional comparative test runs. Tensile swelling tests carried out in a restricted parameter range similarly showed no influence of hot gas. Light microscopic and metallurgical post-examination of samples ruptured under hot gas did not give any indication of corrosion damage having penetrated into the inner parts of the material. Findings from material mechanics testing verified this.

50137 (NP—4770527) Microstructure and mechanical properties of titanium alloys. Daeubler, M.A. (Bochum Univ. (Germany, F.R.). Abt. fuer Maschinenbau). 18 Dec 1980. 132p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE84770527.

The influence of microstructure was tested on the mechanical properties in tensile tests, on hardening and softening behaviour and on fatigue time. Attention was chiefly given to the alloy Ti-6Al-4V. For studies of yield point superelevation and of the E-module the alloys Ti-8.8Al-4V, Ti-8.6Al and Ti-4Al were also used. The influence of grain, hardening and texture on the mechanical properties was also studied in tensile tests. Fatigue and alternate deformation tests were carried out in vacuum and in air to study hardening and softening behaviour, to determine low cycle fatigue (LCF) and high cycle fatigue (HCF) and to observe crack formation. Additional aspects included: a) study of yield point superelevation in tensile tests, b) influence of the stress-induced martensitic transformation $\beta \rightarrow \alpha'$ on the behaviour of the alloy, c) influence of the Bauschinger Effect on cyclic deformation, and d) special effects arising from power-driven testing.

50138 (PNL-SA—10761) Amorphous phase formation in irradiated intermetallic compounds. Brimhall, J.L.; Kissinger, H.E.; Charlot, L.A. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1982. Contract AC06-76RL01830. 30p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85000359.

A variety of intermetallic compounds (Ni-Ti, Ni-Al, Fe-Ti, Fe-Al, Re-Ta, Fe-V) have been irradiated with high energy ions (2.5-MeV Ni^+) to determine the criteria for an amorphous transformation. Those compounds with limited compositional range or solubility tend to become amorphous during irradiation, whereas those compounds with wide solubility tend to remain crystalline. This solubility criterion is consistent with the concept that a critical defect density which will result in a greater free energy of the crystal phase than the free energy of the amorphous phase is necessary for the amorphous transformation. This critical defect density is lower in those compounds that become amorphous. The ionicity criterion of Naguib and Kelly does not work for these intermetallic compounds, but the temperature criterion is probably valid and is, in fact, directly related to the proposed solubility criterion.

50139 (SAND—84-1300C) Two-dimensional modeling of conduction-mode laser welding. Russo, A.J.; Benson, D.A.; Hadley, G.R.; Peebles, H.C. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 20p. (CONF-8411100—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001804.

From International conference on applied lasers and electro optics; Boston, MA, USA (12 Nov 1984).

The development of a predictive code for conduction-mode laser welding requires that models for the temperature-dependent absorption coefficient and vaporization interactions should be included with the thermal conduction calculation. An attempt to understand and quantify these surface phenomena by comparison of a two-dimensional code with experimental results is described.

50140 (SLAC-PUB—3378) Surface studies of Nb, its compounds, and coatings. Garwin, E.L.; Kirby, R.E. (Stanford Linear Accelerator Center, CA (USA)). Jul 1984. Contract AC03-76SF00515. 50p. (CONF-840790—2). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84017353.

From 2. workshop on rf superconductivity; Geneva, Switzerland (23 Jul 1984).

A review is given of modern surface physics applied to the Nb-vacuum interface and Nb_3Sn. (LEW)

50141 Critical current density of bronze-processed multifilamentary Nb_3Sn wires with magnesium addition to the matrix. Wu, I.W.; Dietderich, D.R.; Johnson-Walls, P.E.; Glazer, J.; Holthuis, J.T.; Hassenzahl, W.V.; Morris, J.W. Jr. (Materials and Molecular Research Division, Lawrence Berkeley Laboratory and Department of Materials Science and Mineral Engineering, University of California, Berkeley, California 94720). *Applied Physics Letters;* **45**: No. 7, 792-794(1 Oct 1984). Contract AC03-76SF00098.

The effects of the addition of magnesium to the bronze of a bronze-processed multifilamentary Nb_3Sn conductor were studied. The bronze composition was varied from Cu-6.7 Sn-0.0 Mg to Cu-6.7 Sn-0.62 Mg. The magnesium was found to refine the Nb_3Sn grain size and improve the critical current density of the superconductor. The most heavily doped wire had an optimum critical current density three to six times better than the Mg-free control wire at all fields.

50142 Interface magnetism in metals: Ag/Fe(001). Ohnishi, S.; Weinert, M.; Freeman, A.J. (Department of Physics and Astronomy, Northwestern University, Evanston, Illinois 60201 and Fundamental Research Laboratory, NEC Corporation, 1-1 Miyazaki 4-chome, Miyamae-ku, Kawasaki, Kanagawa 213, Japan). *Physical Review [Section] B: Condensed Matter;* **30**: No. 1, 36-43(1 Jul 1984). Contract AC02-76CH00016.

A study of the effect of an ordered overlayer of Ag on the magnetism of an Fe(001) surface is presented. In order to understand the changes induced at the Ag/Fe interface, a series of self-consistent spin-polarized local-spin-density calculations were carried out with the use of our all-electron, full-potential, linearized augmented-plane-wave method. While the charge density is found to approach the bulk value within approximately one layer of the interface, the spin density at the interface is found to be strongly perturbed. An enhancement of the Fe magnetic moment at the interface (to 2.52μ/sub B//atom) is predicted which, however, is significantly less than that found for the clean Fe(001) surface (2.95μ/sub B/). The role of the Ag overlayer in delocalizing the Fe surface states responsible for the increased surface magnetization and the effect on the single-particle spectra is described and discussed. The effect of the surface and interface on the contact hyperfine fields is evaluated: The (negative) core-polarization contribution is found to scale with the moment, but the valence contribution changes sign from negative in the interior to positive at the surface. The physical basis and the relationship of these results to the interpretation of Moessbauer-effect measurements of the hyperfine field are described.

50143 Embedded-atom method: Derivation and application to impurities, surfaces, and other defects in metals. Daw, M.S.; Baskes, M.I. (Sandia National Laboratories, Livermore, California 94550). *Physical Review [Section] B: Condensed Matter;* **29**: No. 12, 6443-6453(15 Jun 1984).

We develop the embedded-atom method [Phys. Rev. Lett. 50, 1285 (1983)], based on density-functional theory, as a new means of calculating ground-state properties of realistic metal systems. We derive an expression for the total energy of a metal using the embedding energy from which we obtain several ground-state properties, such as the lattice constant, elastic constants, sublimation energy, and vacancy-formation energy. We obtain the embedding energy and accompanying pair potentials semiempirically for Ni and Pd, and use these to treat several problems: surface energy and relaxation of the (100), (110), and (111) faces; properties of H in bulk metal (H migration, binding of H to vacancies, and lattice expansion in the hydride phase); binding site and adsorption energy of hydrogen on (100), (110), and (111) surfaces; and lastly, fracture of Ni and the effects of hydrogen on the fracture. We emphasize problems with hydrogen and with surfaces because none of these can be treated with pair potentials. The agreement with experiment, the applicability to practical problems, and the simplicity of the technique make it an effective tool for atomistic studies of defects in metals.

50144 Edge states and quantized Hall conductivity in a periodic potential. MacDonald, A.H. (Division of Physics, National Research Council of Canada, Ottawa, Canada K1A0R6 and Institut fuer Theoretische Physik, Eidgenossische Technische Hochschule Hoenggerberg, Zuerich 8093, Switzerland). *Physical Review [Section] B: Condensed Matter;* **29**: No. 12, 6563-6569(15 Jun 1984). Contract AC04-76DP00789.

The electronic structure of an infinitely long two-dimensional strip of finite width in a weak periodic potential and a strong magnetic field has been calculated. In an infinitely wide strip there are gaps within each Landau level, with the number of gaps depending on the product of the area of the unit cell and the magnetic field. For finite-width strips, edge states appear in these intra-Landau-level gaps. A relationship between the Hall conductivity when the Fermi level lies in one of these gaps and the number and dispersion of the edge states is established. Results for the electronic structure are presented for several cases and are shown to imply values for the Hall conductivity in agreement with those expected on the basis of Kubo-formula expressions for an infinite system.

50145 Interphase boundary precipitation in liquid phase sintered W-Ni-Fe and W-Ni-Cu alloys. Muddle, B.C. (Monash Univ., Clayton, Victoria, Australia). *Metallurgical Transactions, [Section] A: Physical Metallurgy and Materials Science;* **15A**: 1089-1098(Jun 1984). Contract AC02-76ER01198.

A serious potential of embrittlement in liquid-phase sintered, tungsten-based heavy alloys is related to the precipitation of a brittle third phase along tungsten-matrix interphase boundaries. The present investigation is concerned with the identification of the phase observed to form at the tungsten-matrix interphase within a commercial W-Ni-Fe alloy containing a weight fraction Ni:Fe of

1:1. A severely embrittled sample of a commercial W-4.5 wt pct Ni-4.5 wt pct Fe alloy and heat treated specimens of a W-7.2 wt pct Ni-2.4 wt pct Cu alloy were used in a study of interphase boundary precipitation. It was possible to identify the embrittling interphase boundary precipitate formed in commercial W-4.5 wt pct Ni-4.5 wt pct Fe alloy. The interphase boundary precipitation of an intermetallic phase in W-7.2 wt pct Ni-2.4 wt pct Cu alloy under controlled conditions of heat treatment could also be confirmed. 34 references.

50146 **Sonic resonator control and method for determining component concentration in multiple component molten liquids.** Shen, S. (to Dept. of Energy). US Patent 4,447,301. 8 May 1984. Filed date 29 Oct 1982. vp.

PAT-APPL-437787.

This invention teaches a control to be used in smelting aluminum by the electrolysis breakdown of alumina (Al_2O_3) in a molten electrolyte heated to approximately 950°-1000° C. The invention provides a sonic resonator and control that can accurately detect the resonant frequency of the resonator in the molten electrolyte. The resonator preferably is made with tubular side wall 1/4 of the sonic wavelength, or is a quarter wave resonator. A wave generator inputs a signal having a range of frequencies that includes the resonant frequency, so that a peak resonant output at the resonant frequency can be detected on an oscilloscope or like detector. This instantaneous resonant frequency is then checked against an accurate data base correlating the resonant frequencies of the resonator in the electrolyte at specific alumina concentrations normally experienced throughout the electrolysis cycle. The electrolysis cycle can thus be controlled and recharged at any predetermined low alumina concentration greater than where the anode effect phase of the cycle normally might begin.

50147 **Slag capture and removal during laser cutting.** Brown, C.O. (to Dept. of Energy). US Patent 4,447,701. 8 May 1984. Filed date 28 Jan 1982. vp.

PAT-APPL-343609.

Molten metal removed from a workpiece in a laser cutting operation is blown away from the cutting point by a gas jet and collected on an electromagnet.

50148 **Method for preparing surfaces of metal composites having a brittle phase for plating.** Coates, C.W.; Wilson, T.J. (to Dept. of Energy). US Patent 4,437,956. 20 Mar 1984. Filed date 19 May 1982. vp.

PAT-APPL-379799.

The present invention is directed to a method for preparing surfaces of two-phase metal composites having relatively brittle and malleable components for plating with corrosion-resistant material. In practice of the present invention, the surfaces of the composites are etched to remove a major portion or fraction of the brittle component. The etched surface is then peened with particulates for breaking the brittle component from the surfaces and for spreading or smearing the malleable component over the surfaces. The peened surface is then chemically cleaned of residual traces of the brittle component so as to provide a surface of essentially the malleable component to which the corrosion-resistant material may be plated thereon in an adherent manner.

50149 **Application of heavy-ion-induced x-ray satellite emission to alloys.** Rosseel, T.M.; Young, J.P.; Dale, J.M.; DasGupta, A.; Hulett, L.D.; Krause, H.F.; Liu, C.T.; Raman, S.; Vane, C.R. (Oak Ridge National Lab., TN). *Journal of Physics F: Metal Physics;* **14**: No. 3, L37-L41(Mar 1984).

High-resolution measurements of heavy-ion-induced x-ray satellite emission (HIXSE) spectra have been obtained for a series of Mo-Ti binary alloys and V(Fesub(x)Cosub(y)Nisub(z)) $_3$ long-range-ordered (LRO) alloys. Variations in the relative intensity distribution of the satellite lines of these alloys were observed and are attributed to the influence of the valence-electron distribution or chemical environment of the emitting target atom. Results are also presented which demonstrate the ability of the method to differentiate between different crystal structures of the same alloy.

50150 **(LA-tr—84-42) Thermodynamic properties of gamma-uranium in the formation of solid solutions with alpha-transition metals.** Vamberskii, I.V.; Ivanov, A.E.; Ivanov, O.S. (Los Alamos National Lab., NM (USA); AN SSSR, Moscow. Inst. Metallurgii). 1984. Contract W-7405-ENG-36. Translated from Thermodyn. Nucl. Mater., Proc. Int. Symp, Vol. 1; IAEA, Vienna, Austria, 1980, pp 235-247. 16p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000239.

An electromotive force (EMF) method involving the use of a liquid chloride electrolyte was used for measuring the variations in the chemical potential of uranium in the formation of solid solutions: in U-Nb-Mo with a Nb and Mo atomic ratio of 1:1 and an (Nb+Mo) concentration of 5, 10 and 15 at. %; in U-Nb-Zr with a niobium and zirconium atomic ratio of 1:1 and an (Nb+Zr) concentration of 15 at. %; in U-Pd, with a Pd concentration of 2 and 20 at. %; in the system U-V, with a V concentration of 4, 7, 30, 45, 55, 80 and 98 at. %. The measurements were performed in the 1048 to 1173° range. The activity and the variations in entropy and enthalpy of uranium were calculated. Comparisons were made of the concentration dependences of variations in the chemical potential of γ-uranium when some α-transition metals were dissolved in it. In the case of the U-V system calculations were made of partial thermodynamic functions of V, variations in the Gibbs free energy, the entropy and enthalpy of mixing, and also of excess values of variation in the Gibbs free energy and entropy. The thermodynamic properties of alloys in the U-Nb and U-V systems were compared. It was found that a solution of γ-uranium in V is formed with the release of a large amount of heat and it has a negative entropy of mixing of considerable magnitude (ΔH=-1.419 kcal.(g-at)$^{-1}$, ΔS=-1.056 cal.(g-at)$^{-1}$.K^{-1} for a saturated solution concentration of $\sim$ 3 at. % U).

50151 **Surface core-level shifts for Ge(100)-(2 x 1).** Miller, T.; Rosenwinkel, E.; Chiang, T.C. (Univ. of Illinois at Urbana-Champaign). *Solid State Communications;* **47**: No. 11, 935-938(1983). Contract AC02-76ER01198.

Using surface-sensitive photoemission techniques, Ge 3d core-level binding energies for surface atoms of Ge(100)-(2 x 1) are found to be smaller than the bulk values by 0.41 eV. The surface atoms with shifted core-level binding energies correspond to one full (100) atomic layer. A surface core-exciton resonance is observed in the partial-yield measurements. The empty surface state involved in this excitonic transition, without binding-energy correction, is located at the valence-band maximum. 14 references, 2 figures, 1 table.

50152 **Oxidation-sulfidation behavior of materials in coal-conversion environments.** Natesan, K.; Dapkunas, S.J. (Argonne National Lab., IL). *Transactions of the Japan Institute of Metals, Supplement;* **3**: 411-418(1983).

The oxidation-sulfidation behavior of structural alloys in complex multicomponent gas environments is of considerable interest for their effective utilization in coal-conversion schemes. Experimental studies have established the need for alloys that develop protective oxide scales on exposure to complex gas atmospheres, since the growth rates of sulfide layers are orders of magnitude larger than those of oxide layers and lead to unacceptable corrosion rates. The interactions among the oxygen and sulfur partial pressures in the gas phase, alloy chemistry, temperature, and pressure to produce a stable, adherent oxide scale on the metal surface are described. Recently developed information on the morphology of surface scales in Incoloy 800 is used to address sulfur resistance of scales and to define regimes for corrosion protection via oxide formation on the materials. The principal materials used in elevated-temperature regions of coal gasification and combustion systems are iron- and nickel-base alloys with chromium as a major constituent.

50153 **Segregation and crystallization phenomena in germanium.** Clark, G.J.; Cullis, A.G.; Jacobson, D.C.; Poate, J.M.; Thompson, M.O. (IBM Thomas J. Watson Research Center, Yorktown Heights, NY 10598). pp 303-310 of Laser solid interactions and transient thermal processing of materials. Narayan, J.; Brown, W.L.; Lemons, H.A. Amsterdam, Netherlands; Elsevier Science Publishing (1983). (CONF-8211153—).

From MRS symposium on laser-solid interactions and transient thermal processing of materials; Boston, MA, USA (1 Nov 1982).

While many studies have been made of liquid phase epitaxy impurity trapping and segregation in Si little is known about the equivalent processes in Ge. In this paper the authors have laser annealed Ge <100> and <111> crystals implanted, at liquid nitrogen temperature, with 200 keV ^{210}Bi ions to doses of 2 x 10^{15} and 10^{16} ions cm^{-2}. The samples were annealed with Q-switched ruby lasers and an XeCl excimer laser. We have observed 1) velocity and orientation dependence of the Bi segregation coefficient 2) interface instability and cell formation resulting from constitutional supercooling and 3) amorphization and defect production at high velocities. The phenomena are shown to be analogous to those seen in Si.

50154 **Linear zone-melt recrystallized Si films using incoherent light.** Kamgar, A.; Knoell, R.; Rozgonyi, G.A. (Bell Laboratories, Murray Hill, New Jersey). pp 569-574 of Laser solid interactions and transient thermal processing of materials. Narayan, J.; Brown, W.L.; Lemons, H.A. Amsterdam, Netherlands; Elsevier Science Pub. (1983). (CONF-8211153—).

From MRS symposium on laser-solid interactions and transient thermal processing of materials; Boston, MA, USA (1 Nov 1982).

Incoherent tungsten radiation has been used to recrystallize polysilicon films deposited on SiO_2, grown on 75 mm diameter wafers. These films have been analyzed by a variety of techniques such as optical microscopy, Auger spectroscopy and TEM cross-sectioning. These films are large (> 50 mm dia.) single crystals, and contain fewer defects and impurities than similar films recrystallized in graphite strip heater ovens. They do, however, contain the subgrain boundaries found previously, even when high purity MBE polysilicon is used. In vertical TEM cross-sectioning, in addition to the subgrain boundaries, crystallized particles of 50200 A size in the Si film at both the upper and lower SiO_2 boundaries have been seen. Although these particles could be related to formation of the subgrain boundaries, no definite correlation has been made.

50155 **Submicron conductor array fabricated from a recrystallized eutectic thin film.** Cline, H.E. (General Electric Corporate Research and Development, P.O. Box 8, Schenectady, NY 12301). pp 727-731 of Laser solid interactions and transient thermal processing of materials. Narayan, J.; Brown, W.L.; Lemons, H.A. Amsterdam, Netherlands; Elsevier Science Pub. (1983). (CONF-8211153—).

From MRS symposium on laser-solid interactions and transient thermal processing of materials; Boston, MA, USA (1 Nov 1982).

A submicron conductor array was fabricated without using lithography by selectively etching a recrystallized Al-Al_2Cu eutectic alloy thin film. The 2 micron thick eutectic films were deposited on glass substrates and directionally solidified with both a quartz-iodine lamp and a scanning laser at rates between .0016 and .14 cm/sec. The resulting structure consisted of alternate parallel stripes of the two eutectic phases with a spacing between .5 and 4 microns that was controlled by the solidification rate. An array of submicron Al- rich conductors was fabricated by selectively etching away the Al_2Cu phase. At solidification rates greater than .004 cm/sec using the lamp heater the solid-liquid interface became nonplanar while with the laser the structure was well alligned at the highest rates used, .14 cm/sec. At the maximum theoretical solidification rate that produces a two phase aligned eutectic structure the width of the Al wires would be 100A.

50156 **Aluminum alloy performance in industrial air-cooled applications.** Wheeler, K.R.; Johnson, A.B. Jr.; May, R.P. (Pacific Northwest Laboratories, Richland, Washington). *American Society for Testing and Materials, Special Technical Publication;* **767**: 116-134(1982).

Air-cooled equipment has an impressive record of performance in industrial cooling applications, particularly in rural-dry environments. At temperatures below the dew point, however, combinations of moisture and contaminants (particularly chlorides and some sulfur compounds) promote severe corrosion on aluminum. Washing the cooling surfaces with some commercial detergents provides a corrosive environment, particularly on areas where drainage collects. Coal dust deposits have caused corrosion of aluminum fins. Marine-humid-industrial locations have caused severe corrosion problems on aluminum air-cooled equipment, particularly when the coolers are at ambient temperatures for extended periods. The results of the domestic survey and available specimens have directed this study principally to aluminum. However, the foreign survey, which is summarized here, provided some insights into the behavior of galvanized steel cooling towers.

3602 Ceramics, Cermets, And Refractories

REFER ALSO TO CITATION(S) 36020049784, 49784, 50751

50157 **(CONF-840760—14) Formation of amorphous layers in Al_2O_3 by ion implantation.** White, C.W.; Farlow, G.C.; McHargue, C.J.; Sklad, P.S.; Appleton, B.R. (Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC05-84OR21400. 19p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001289.

From Ion beam modification of materials conference; Ithaca, NY, USA (16 Jul 1984).

Two methods are described which can be used to turn the near-surface region of Al_2O_3 amorphous by ion implantation. Epitaxial recrystallization of the amorphous region by thermal annealing is demonstrated. Changes in the physical and structural properties as a result of implantation are correlated with changes in the mechanical properties (microhardness).

50158 **(CONF-840767—5) Reliability of the quantification of EELS measurements.** Sklad, P.S.; Bentley, J.; Angelini, P.; Lehman, G.L. (Oak Ridge National Lab., TN (USA); Oak Ridge Associated Universities, Inc., TN (USA)). 1984. Contract AC05-84OR21400. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001242.

From Microbeam Analysis Society analytical electron microscopy meeting; Bethlehem, PA, USA (19 Jul 1984).

Effort has been expended on developing TiB_2 for applications which take advantage of its high hardness, high melting point, and chemical inertness. The major portion of this work has centered on the TiB_2-Ni system. AEM has been used extensively to provide microstructural information for structure-property correlations. Particular emphasis has been placed on identifying phases which develop during high temperature exposure. Electron energy loss spectroscopy (EELS) has been an important tool. However, repeated analyses of secondary phases, as well as of TiB_2 itself, lead to the conclusion that compositions determined by quantification of EELS spectra with the use of both K and L ionization edges were suspect. In an earlier paper, it was suggested that the problem might lie in the computation of cross sections for L absorption edges. Since that time our interest in this problem has continued and we have concentrated on identifying with greater certainty the source of the inaccuracy. This paper discusses the results of our investigations.

50159 **(CONF-8409117—3) Surface mechanical properties and wear behavior of ion implanted TiB_2.** McHargue, C.J.; Yust, C.S.; Angelini, P.; Sklad, P.S.; Lewis, M.B. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 15p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001130.

From 2. international conference on the science of hard materials; Rhodes, Greece (23 Sep 1984).

Implantation of 1 x 10^{17} Ni.cm^{-2} (1 MeV) into polycrystalline TiB_2 produced an altered microstructure to a depth of 750 nm. The implantation damage was in the form of coarse dislocation tangles near the surface and fine damage structure at greater depths. The surface mechanical properties, as measured by Knoop microindentation hardness, indentation fracture toughness and scratch-wear resistance, were increased by 50 to 110% by implantation. During pin-on-disk tests, entire grains were removed by the process of grain boundary cracking.

50160 **(CONF-8409130—4) Reactivity of ion implanted silicon carbide.** McHargue, C.J.; Lewis, M.B.; Williams, J.M.; Appleton, B.R. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001543.

From International conference on surface modification of metals by ion beams; Heidelberg, F.R. Germany (17 Sep 1984).

Implantation of chromium into single crystalline or polycrystalline α-SiC produces a surface amorphous layer for displacement damage greater than 0.2 dpa at room temperature. The enhanced chemical reactivity of such specimens was studied by two methods. The chemical etching rates in a saturated solution of 50% $K_3Fe(CN)_6$-50% KOH were measured. The etching rate for the amorphous layer was 2.4 to 3.7 times that of the crystalline material for polycrystalline samples and 3.0 to 4.1 times as great for single crystal samples. Polycrystalline specimens were exposed to flowing oxygen for 1 h at 1300°C. Rutherford backscattering and the nuclear reaction O(d,p) were used to determine the amount of oxygen on the surface. The amount of oxygen (and thickness of oxide) over the amorphous region was 1.67 times that over the crystalline region. The relative thickness of the oxide on the amorphous and crystalline regions was confirmed by measuring the sputtering time required to remove the oxygen signal in an Auger spectrometer.

50161 **(KFK—3660) Relations between material properties and performance of wear resistant materials.** Preikschat, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Material- und Festkoerperforschung; Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Maschinenbau). Apr 1984. 245p. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE85750064.

Commercially available, wear resistant materials and alloys based on the elements Ti, Mo, Nb, V, Ni, Fe were characterized by their laboratory properties and performance under workshop conditions. WC-Fe, Co, Ni- and (Ti, Mo)Csub(1-x) -hardmetals are equal to commercial alloys in regards of hardness and toughneas. Under abrasive conditions WC-base alloys with asmall carbide grain size exhibit the highest wear resistance. Titanium base hardmetals are inferior due to their lower phase boundary strength. The performance of hardmetals in metal cutting is strongly related to hot-hardness, Palmqvist-toughness and their microstructure. (Ti,Mo)Csub(1-x) and (Ti,V,Nb)C-hardmetals are superior to WC-base alloys in cutting low alloy steels whereas the studied cutting tools based on favourable raw materials are inferior in cutting cast iron. This refers to their lower abrasion resistance. A proper selection, application and development of wear resistant materials is possible considering their properties and wear mechanisms.

50162 **(LBL—17954) Sub-eutectic densification and second phase formation in Al_2O_3 - CaO.** Wu, S.J.; De Jonghe, L.C. (Lawrence Berkeley Lab., CA (USA); California Univ., Berkeley (USA). Dept. of Materials Science and Mineral Engineering). Jun 1984. Contract AC03-76SF00098. 25p. (CONF-8405244—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85002065.

From 86. annual meeting of the American Ceramic Society; Pittsburgh, PA, USA (2 May 1984).

The early and intermediate densification stages of calcia containing alumina were examined at sub-eutectic temperatures. Up to 0.15% wt % calcia causes a decrease in the densification rates; from 0.15 to 0.7 wt % calcia an increasing densification rate is observed; more than 0.75 wt % calcia leads to a montonically decreasing densification rate. The data are interpreted as a competition between grain-boundary defect chemistry, enhanced subeutectic densification, and formation of calcium-aluminate phases of lower calcia activity.

50163 **(MLM—3156(OP)) Properties and thermal stabilities of amorphous transition metal hydrides.** Bowman, R.C. Jr.; Cantrell, J.S.; Venturini, E.L.; Schulz, R.; Wagner, J.E.; Attalla, A.; Craft, B.D. (Monsanto Research Corp., Miamisburg, OH (USA). Mound; Miami Univ., Oxford, OH (USA). Dept. of Chemistry; Sandia National Labs., Albuquerque, NM (USA); California Inst. of Tech., Pasadena (USA)). 1984. Contract AC04-76DP00789;AC04-76DP00053. 5p. (CONF-8409107—7). NTIS, PC A02/MF A01; GPO Dep. File Number DE85002117.

From 5. international conference on rapidly-quenced metals; Wurzburg, F.R. Germany (3 Sep 1984).

Amorphous a-Zr_3PdH/sub x/ and a-Zr_3RhH/sub x/ exhibit enhanced proton diffusion relative to that observed in related crystalline hydrides. The magnetic susceptibilities and superconducting T/sub c/ values for these glasses indicate systematic decreases in the densities of Fermi level electronic states with increasing hydrogen content. When the glassy alloys are heated above 700K, they undergo exothermic transitions to form crystalline intermetallics. However, the glassy hydrides irreversibly decompose to produce crystalline ZrH/sub x/ under similar conditions. Several differences are noted between the thermal stabilities of a-Zr_3PdH/sub x/ and a-Zr_3RhH/sub x/.

50164 **(NP—4770525) Study of the gas phase deposition of silicon carbide and its application for impregnation of reactively bound silicon carbide and for the manufacture of SiC/SiC composites.** Hegen, D. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Chemie). 26 Jan 1979. 144p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE84770525.

A search has been made to find ways of improving the mechanical properties of polygranular SiC materials such as strength and cracking properties, while at the same time retaining their good chemical stability. For this reason the effects of foreign elements on the manufacture of reactively bound materials and on the final properties of the SiC materials were studied initially. The main part of this research, however, was concerned with attempts to achieve improved high-temperature stability, at the same time with good stability towards creep and oxidation, for a material which is as pure as possible and free of sintering agents. Reaction sintered types are suitably pure SiC materials but are always porous. Two approaches were chosen for improving the properties of RB-SiC materials: 1) Reduction of pore volume and alteration of pore structure by impregnation with polygranular, porous SiC; 2) incorporation of reinforced fibres in polygranular SiC composites. The relatively simple, one-stage impregnation procedure from the gas phase with the aid of methyl chlorsilanes was studied. This study should provide the basis for the decision as to whether industrial application may be possible at a later stage. The same technique of chemical gas phase deposition was finally studied under widely varying conditions of deposition for the manufacture of SiC fibre-reinforced SiC composites.

50165 **Synthesis of refractory materials.** Holt, J.B. (to Dept. of Energy). US Patent 4,459,363. 10 Jul 1984. Filed date 16 Aug 1983. vp.

PAT-APPL-523556.

Refractory metal nitrides are synthesized during a self-propagating combustion process utilizing a solid source of nitrogen. For this purpose, a metal azide is employed, preferably NaN_3. The azide is combusted with Mg or Ca, and a metal oxide is selected from Groups III-A, IV-A, III-B, IV-B, or a rare earth metal oxide. The mixture of azide, Ca or Mg and metal oxide is heated to the mixture's ignition temperature. At that temperature the mixture is ignited and undergoes self-sustaining combustion until the starter materials are exhausted, producing the metal nitride.

50166 **Method for removing oxide contamination from titanium diboride powder.** Brynestad, J.; Bamberger, C.E. (to Dept. of Energy). US Patent 4,452,767. 5 Jun 1984. Filed date 26 Apr 1983. vp.

PAT-APPL-488802.

A method for removing oxide contamination from titanium diboride powder involves the direct chemical treatment of TiB_2 powders with a gaseous boron halide, such as BCl_3, at temperatures

in the range of 500°-800°C. The BCl_3 reacts with the oxides to form volatile species which are removed by the BCl_3 exit stream.

50167 **Effect of crystallization of the grain-boundary phase on the thermal diffusivity of a sialon ceramic.** Bentsen, L.D.; Hasselman, D.P.H. (Virginia Polytechnic Inst. and State Univ., Blacksburg, VA). *Journal of the American Ceramic Society;* C.85-C.86(May 1984). Contract AC02-80ER10619.

Crystallization of the glassy grain-boundary phase in a series of sialon ceramics fabricated using a range of hot-pressing schedules increased the thermal diffusivity at room temperature by an average of about 10 percent. For samples made by a given hot-pressing schedule, the relative difference in thermal diffusivity between composites containing a glassy grain-boundary phase and those in which this phase had crystallized decreased with increasing temperature. This behavior is attributed to enhanced phonon scattering in the crystalline grain-boundary phase. 5 references.

50168 **Thermionic emission and vaporization behavior of the ternary systems of lanthanum hexaboride containing molybdenum boride, molybdenum diboride, zirconium diboride, gadolinium hexaboride, and neodymium hexaboride.** Storms, E.K. (Los Alamos National Lab., NM). *Journal of Applied Physics;* **52**: No. 2, 1076-1081(Feb 1983).

The addition of various compounds to LaB_6 did not improve the thermionic emission over that of pure LaB_6. This experience and general conclusions, which result by considering the vaporization properties of these and other materials, greatly limit the options available to improve the properties of LaB_6 by forming a ternary system. The principles which must be considered, in order to simplify future work, are described. 10 references, 7 figures, 6 tables.

50169 **(UCRL-Trans—11997) Precipitation of the W_2C semicarbide of tungsten in tungsten sheets.** Epicier, T.; Esnouf, C. Translated from *Journal of the Less-Common Metals ;* **90**: L31-L33(1983). Contract W-7405-ENG-48. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016069. DE84016069

Precipitation of hexagonal Me_2C has been observed in V-C, Nb-C, Mo-C, and Ta-C. This paper describes preliminary observations of the precipitation of W_2C in carbonized tungsten. (DLC)

50170 **(UCRL-Trans—11996) Investigation of the growth kinetics of metal carbide systems.** Chermant, J.L.; Coster, M.; Deschanvres, A.; Iost, A. Translated from *Journal of the Less-Common Metals ;* **52**: 177-196(1977). Contract W-7405-ENG-48. 31p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84016061. DE84016061

In this work a kinetic law has been established for grain growth in the systems WC-Co, TiC-Co and TiC-Ni. Use was made of the analytical methods of quantitative metallography and stereology which enable us amongst other things to establish the shape of the curve of the growth of metal carbides and, using the Saltykov corrections, to determine the distribution of equivalent sphere diameters. The development of the crystal shape, as given by the Smith index, showed the growth of WC to be anisotropic. Results show that the rate in the three systems is limited by a second-order reaction at the interface. The experimental values are in agreement with the theory established by Kahlweit. The rate constant of the reaction at the interface $V = k\,[M]\,(s)\,[C]\,(s)$, for the slow reaction $M(s) + C(s) \rightarrow MC(c)$, was determined.

50171 **(ANL-Trans—517) Existence and structure of rare earth monocarbides: study of their magnetic properties at low temperatures.** Lallement, R. (Argonne National Lab., IL (USA); CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). Sep 1967. Contract W-31-109-ENG-38. Translation of CEA-R 3043, 1966. 90p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE84017621.

We investigated the physical properties of the rare earth monocarbides. These carbides have fcc structures and have many carbon gaps. We proposed a rare earth-carbon equilibrium phase diagram whose essential characteristic is the existence of an M_2C phase arising from the face centered cubic phase through ordering of the carbon atoms. X-ray diffraction crystallographic studies and the neutron diffraction work on the M_2C phase were used to determine the structure. M_2C is rhomohedral, and the order of the carbon atoms can be described as an alternation of full and empty planes perpendicular to the ternary axis. All the carbides exhibit magnetic ordering phenomena of the M³/sup +/ ions at low temperatures. The magnetic properties are fairly complicated. The carbides can be said to be ferromagnetic, but their magnetic structure is not simple. Assuming the trivalent ions couple through the conduction electrons, the coupling function being the Ruderman-Kittel oscillating function, it is possible to interpret the transition temperatures, the magnetic resistivities, and the variation in the transition temperature as a function of the carbon content. The calculations lead us to assume that the number of almost free conduction electrons which couple the ions together is slightly larger than the number of electrons in the rare earth metals, as if the carbon provides about one electron per atom to the metal conduction band. Interpretation of the phenomena of local order produced around the transition temperature leads to analogous conclusions. In the series, keeping similar electronic structures for the carbide and the metal, assuming that the carbon given up a conduction electron to the metal, and applying classical theories of coupling for metal, we can account for most of the phenomena which we observed. Considering the uniqueness of the properties measured, the rare earth monocarbides are as good metals as the rare earths themselves.

3603 Composite Materials

50172 **(BNL—34086) Hydrothermal durability of Ca-complexed methylmethacrylate-trimethylolpropane trimethacrylate copolymer films and coatings containing superficially formed $CaO\text{-}SiO_2\text{-}H_2O$ type inorganic macromolecules.** Sugama, T.; Kukacka, L.E. (Brookhaven National Lab., Upton, NY (USA)). Dec 1983. Contract AC02-76CH00016. 40p. (CONF-841124—1). NTIS, PC A03/MF A01; GPO Dep. File Number DE84008176.

From Scientific conference on chemical defense research; Millersville, MD, USA (1 Nov 1984).

A $CaO\text{-}SiO_2\text{-}H_2O$ macromolecular-ionomer complex was found to be formed in the superficial layers of MMA-TMPTMA copolymer composite films made with filler containing hydraulic cement during exposure in an autoclave at temperatures up to 200°C. This superficially formed complex in terms of self-healing protective layers, acted to prevent the hydrothermal deterioration of the original composite films, which is important if the films are used as protective layers on metals. Studies of the adhesion of the complex composite coatings to chemically treated metal surfaces were also performed. It was found that the surface topography of hopeite crystalline layers results in an increase in wetting forces and mechanical interlocking forces.

50173 **(CONF-840171—1) Fabrication of ceramic-ceramic composites by chemical vapor deposition.** Stinton, D.P.; Lackey, W.J.; Lauf, R.J.; Besmann, T.M. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 19p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000981.

From Conference on composites and advanced ceramic materials; Cocoa Beach, FL, USA (16 Jan 1984).

Toughened ceramic composites were produced by the simultaneous chemical vapor deposition of two phases. Fracture toughness values were nearly double the value of SiC when CH_3SiCl_3 and $TiCl_4$ vapors were used to produce SiC-$TiSi_2$ composites. Other systems consisting of SiC and the metal or metal carbides of Ni, Cr, W, and Mo were examined. Equilibrium thermodynamic analyses of these systems were performed as a function of the chemical vapor deposition variables: temperature, total pressure, and reactant concentration. These calculations confirmed that the volatile species used early in this work (organometallic compounds of Ni and Cr and the fluorides of W and Mo) were not suitable for the production of toughened composites. Additional work is under way to produce composites from the oxychlorides or carbonyls of Ni and Cr or the chlorides or oxychlorides of W and Mo. Thermodynamic calculations also indicated that SiC and TiC should be co-deposited when CH_3SiCl_3, $TiCl_4$, and a hydrocarbon are used as

the coating gases. Much additional work remains to produce SiC-TiC composites and to control the morphology of the $TiSi_2$ dispersed phase so that optimum fracture toughness values can be obtained.

50174 **(LA-UR—84-2936) Fabrication of SiC whiskers and composites.** Hurley, G.F.; Shalek, P.D.; Gac, F.D.; Petrovic, J.J. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 24p. (CONF-8411102—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85002038.

From Conference on metal and ceramic matrix composite processing; Columbus, OH, USA (12 Nov 1984).

The Los Alamos Structural Ceramics Program is a multi-faceted program with an overall objective of producing superior strength and fracture toughness in ceramic bodies for load bearing applications. One phase of the program is pursuing the development of silicon carbide whiskers which are used to prepare ceramic matrix composites. The purpose of this work is to investigate strengthening and toughening mechanisms in ceramic composites. In the following we describe some elements of the whisker development program in which we are endeavoring better to characterize the whisker growth process in order to scale up its production potential. We have used these whiskers in the preparation of four types of ceramic matrix representative of a range of materials. The nature and reasons for choosing these materials are described. Composites have been prepared by dry-blending followed by hot pressing which yields high density bodies. In addition we are beginning an investigation of wet processing (slip casting) to produce a silicon-silicon carbide body which will be reaction sintered in nitrogen. Composites of glass-, hot pressed silicon nitride -, and molybdenum disilicide - silicon carbide whiskers have been tested in flexure to determine strength and fracture toughness. Results have been promising, with substantial toughening exhibited in all systems, and strengthening in the glass and $MoSi_2$ composites. The reaction bonded silicon nitride is not yet to the testing stage.

3604 Polymers And Plastics

50175 **(DOE/ER/10922—T1) Microstructural analysis of ion containing polymers. Final report, July 1, 1981-June 30, 1984.** Cooper, S.L. (Wisconsin Univ., Madison (USA). Dept. of Chemical Engineering). Jul 1984. Contract AC02-81ER10922. 32p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85001594.

The microstructure of several ionomer systems has been investigated using techniques which probe different aspects of the structure. A liquid-like hard-sphere interparticle scattering model was proposed for the ionic domain morphology and has been shown to be superior to intra-particle scattering models in the literature. The result of applying this model to the experimental SAXS data implies that the ionic domain structure is determined by the polymer backbone and comonomer group anion but is independent of overall ion content, temperature and type of cation. EXAFS analysis has shown drastic differences in the local cation environment between momovalent alkali metal and divalent transition metal cations. More subtle differences were observed between cations in Nafion and those in sulfonated polystyrene ionomers (SPS). Two well-ordered near-neighbor shells were evident for the Zn^{2+} cation in SPS. A coordination structure based on the EXAFS data has been proposed for the Zinc-sulfonate groups in the SPS ionomer. This model is also consistent with the SAXS analysis.

50176 **(DOE/ER/13126—T1) New polymer electrodes and conductors based on poly(hydroquinone/quinone) oxidation/reduction systems. Technical progress report.** Litt, M.H.; Rickert, S.E. (Case Western Reserve Univ., Cleveland, OH (USA)). 1 Oct 1984. Contract AC02-83ER13126. 22p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000958.

Polyhydroquinone can be synthesized according to the mentioned reactions, provided the reaction conditions are controlled carefully. The product formed can be easily isolated from the sulpholane as the same is highly miscible with water. The absence of sulpholane can be quantitatively checked. The polymer can be made to remain in solution.

50177 **(DOE/ER/75016—T3) Effect of pressure on the mechanical properties of polymers. Part II. Measurement of the time-dependent Poisson's ratio. Final report.** Tschoegl, N.W. (California Inst. of Tech., Pasadena (USA). Dept. of Chemical Engineering). Oct 1984. Contract AT03-76ER75016. 65p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85002139.

An attempt was made to measure the time-dependent Poisson's ratio on a styrene-butadiene rubber (SBR). Below -10°C, water condensation occurred when the bath returned to room temperature. These experiments therefore had to be deferred. A sample of a styrene-butadiene block copolymer evinced considerable relaxation at room temperature. The Poisson's ratio is quite high. The high values of $\mu(t)$ recorded on the block copolymer could result from strain-induced anisotropy. Such anisotropy can produce E to G ratios well in excess of 3, the theoretical value for a homogeneous isotropic rubber. By the relation $\mu = E/2G - 1$, an E to G ratio of 3.2 yields a Poisson's ratio of 0.6. $\mu(t)$ clearly shows an inflection around 15 minutes which is just barely noticeable in E(t).

50178 **(UCID—20217) Optimization of the die entrance shape for polymeric extrusion.** Christensen, R.M. (Lawrence Livermore National Lab., CA (USA)). 5 Oct 1984. Contract W-7405-ENG-48. 20p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001588.

Optimal shapes are found for the entrance section to the die in polymer extrusion problems. Simplifying assumptions are introduced to permit direct solution of the non-Newtonian flow problem. The optimal shape is shown to reduce a component of the acceleration gradient by orders of magnitude compared with that existent in standard entrance sections. This difference is related to a corresponding difference in tensile stresses caused by the extensional nature of the flow.

50179 **Electroless metal plating of plastics.** Krause, L.J. (to Dept. of Energy). US Patent 4,459,330. 10 Jul 1984. Filed date 20 Sep 1982. vp.

PAT-APPL-420054.

Process for plating main group metals on aromatic polymers is carried out by the use of a nonaqueous solution of a salt of an alkali metal in a positive valence state and a main group metal in a negative valence state with contact between the solution and polymer providing a redox reaction causing the deposition of the main group metal and the reduction of the polymer. Products from the process exhibit useful decorative and electrical properties.

50180 **Method and composition for molding low density desiccant syntactic foam articles.** Lula, J.W.; Schicker, J.R. (to Dept. of Energy). US Patent 4,447,565. 8 May 1984. Filed date 7 Dec 1981. vp.

PAT-APPL-328327.

A method and a composition are provided for molding low density desiccant syntactic foam articles. A low density molded desiccant article may be made as a syntactic foam by blending a thermosetting resin, microspheres and molecular sieve desiccant powder, molding and curing. Such articles have densities of 0.2-0.9 g/cc, moisture capacities of 1-12% by weight, and can serve as light weight structural supports.

50181 **Dislocation theory.** Li, J.C.M. (Univ. of Rochester, NY). pp 29-43 of Plastic deformation of amorphous and semicrystalline materials. Escaig, B.; G'Sell, C. (eds.). Les Ulis, France; Les Editions de Physique (1982). Contract AC02-76ER02296.

Some concepts of dislocations are presented together with the possibility of applying such concepts to polymers and other amorphous materials. Topics of discussion include: theoretical shear strength; partial slip and dislocations; Burgers circuit and Burgers vector; Volterra dislocations and disclinations; Reneker and Kedzie defects; Somigliana dislocations; Moutier theorem and the point force method; edge dislocation of the z axis; screw dislocation of the z axis; the small loop method; a small interstitial loop; a large interstitial loop; a circular wedge disclination; a small shear dislocation loop; a large shear dislocation loop; a circular twist disclina-

tion; force on a dislocation; interaction between dislocations; intersection between dislocations; and the Orowan equation.

3606 Other Materials

REFER ALSO TO CITATION(S) 36060049557, 49557, 49627, 49629, 50131, 50389, 50420, 50718

50182 (AD-A—142541/2) Thin film synthesis of superconducting chemical compounds. Final report 1 January 1981-30 December 1983. Sienko, M.J.; Hoffmann, R.; Newman, J.A.; Burlitch, J.M. (Cornell Univ., Ithaca, NY (USA). Dept. of Chemistry). 31 May 1984. 15p. NTIS, PC A02/MF A01.

The objective of this research was to define the chemical factors that affect onset of superconductivity in ternary compounds: to determine how small changes in stoichiometry and microstructure influence critical temperature, how the number and placing of magnetic ions act to quench superconductivity, and how the crystal structure can be modified to enhance superconductivity. The approach was to synthesize, from ultrapure starting elements, ternary borides, silicides, sulfides and selenides of the second and third row transition elements, to characterize the new compounds for x-ray structure, electric and magnetic behavior, and then compare them with doped materials. Four kinds of compounds were investigated: rare earth diosmium disilicides, rare earth osmium-iridium borides, layered structure transition metal dichalcogenides, and Chevrel type molybdenum ternaries. Both the rare earth osmium-iridium borides and rare earth diosmium disilicides were synthesized by arc melting. The crystal structures were refined and magnetic susceptibility studies revealed conventional Hund's rule behavior in the disilicides while the (Pr, Nd) (Os, Ir) 4B4 compounds are characterized by Van Vleck paramagnetism of closely spaced multiplets. Only $LaOs_2Si_2$ and $LuOs_2Si_2$ compounds are superconducting with Tc's in the 2-4K range. In the layered compounds, lithium intercalated ZrS_2, $ZrSe_2$, NbS_2, and $NbSe_2$ were studied.

50183 (CONF-840617—7) Arc-evaporated carbon films: optical properties and electron mean free paths. Williams, M.W.; Arakawa, E.T.; Dolfini, S.M.; Ashley, J.C. (Oak Ridge National Lab., TN (USA); Oak Ridge Associated Universities, Inc., TN (USA)). 1984. Contract AC05-84OR21400. 14p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001246.

From 12. DOE surface science/SUBWOG - 7. SUBWOG - 12B technical exchange meeting; Oak Ridge, TN, USA (11 Jun 1984).

This paper describes briefly a method which can be used to calculate inelastic mean free paths for electrons with energies in the range of interest for the interpretation of surface phenomena. This method requires a knowledge of the optical properties of the material for the photon energies associated with the oscillator strength of the valence electrons. However, in general it is easier to obtain accurate values of the required properties than it is to measure the electron attenuation lengths in the energy region of interest. This technique, demonstrated here for arc-evaporated carbon, can be used for any material for which the optical properties can be measured over essentially the whole energy range corresponding to the valence electron response.

50184 (CONF-840760—12) Ion beam processes in Si. Holland, O.W.; Narayan, J.; Fathy, D. (Oak Ridge National Lab., TN (USA); North Carolina State Univ., Raleigh (USA)). Jul 1984. Contract AC05-84OR21400. 20p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001254.

From Ion beam modification of materials conference; Ithaca, NY, USA (16 Jul 1984).

Observation of the effects of implants of energetic ions at high dose rates into Si have produced some exciting and interesting results. The mechanism whereby displacement damage produced by ions self-anneals during high dose rate implantation is discussed. It is shown that ion beam annealing (IBA) offers in certain situations unique possibilities for damage annealing. Annealing results of the near surface in Si with a buried oxide layer, formed by high dose implantation, are presented in order to illustrate the advantages offered by IBA. It is also shown that ion irradiation can stimulate the epitaxial recrystallization of amorphous overlayers in Si. The nonequilibrium alloying which results from such epitaxial processes is discussed as well as mechanisms which limit the solid solubility during irradiation. Finally, a dose rate dependency for the production of stable damage by ion irradiation at a constant fluence has been observed. For low fluence implants, the amount of damage is substantially greater in the case of high flux rather than low flux implantation.

50185 (CONF-840923—2) Phonon properties of $LaNbO_4$ deduced from heat-capacity measurements. Nevitt, M.V.; Knapp, G.S.; Grimsditch, M.H.; Chan, S.K.; Aldred, A.T. (Argonne National Lab., IL (USA)). Aug 1984. Contract W-31-109-ENG-38. 24p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002146.

From 9. European conference on thermophysical properties; Manchester, UK (17 Sep 1984).

In the use of heat capacity measurements to characterize features of the phonon spectrum, a convenient description can be made in terms of averaged properties, or moments, all of which combine to characterize the complete phonon spectrum, and each of which can be represented by a Debye temperature θ/sub D/(n) which relates to a Debye phonon spectrum having the corresponding nth moment of the actual spectrum. We use this approach to analyze the heat capacity of $LaNbO_4$ at 4 to 400°K. θ/sub D/(-3), the Debye temperature corresponding to the lowest frequency modes is 425°K. θ/sub D/(2), identified predominantly with the high frequency modes, and θ/sub D/(0), associated with the geometric mean frequency of the complete spectrum are, respectively, 690°K and 550°K. There is a small negative slope in the linear θ/sub D/(0) vs T relation, which is ascribed to an anharmonic component in the spectrum. The magnitude of this anharmonicity is consistent with the dilational contribution to the heat capacity calculated from the volume coefficient of expansion and the compressibility. We compare these phonon characteristics with those of $CaWO_4$.

50186 (CONF-8404135—4) Growth and properties of semiconductor strained-layer superlattices. Dawson, L.R. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 25p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84012979.

From International conference on metallurgical coatings; San Diego, CA, USA (9 Apr 1984).

Strained-layer superlattices provide a wide range of tailorable electronic and optical properties, much of which cannot be achieved in lattice-matched alloys, or cannot be realized in mismatched alloys without the introduction of undesirable numbers of misfit defects. In some cases the strain can be used to achieve properties that cannot be achieved in any other manner. MBE has been used to prepare $GaAs/In_{0.2}Ga_{0.8}As$ SLS material having high structural integrity, and excellent electrical, optical, and transport properties. Such materials have been incorporated into various device structures, including field effect transistors, photodetectors, and light emitting diodes with excellent initial results.

50187 (DOE/JPL/956312—08) Stress studies in EFG. Quarterly progress report, April 1-June 30, 1984. (Mobil Solar Energy Corp., Waltham, MA (USA)). 15 Aug 1984. Contract NAS-7-100-956312. 70p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85001707.

Electrical characterization of defects induced in FZ and CZ silicon stress in four-point bending above 1200°C has been started. Techniques to study electrical activity that will permit correlation of defect activity with diffusion length and with room and low temperature EBIC are being developed. Preliminary characterization of defects in ribbon grown at very low speeds of less than 1 cm/min shows that the dislocation density is very low over significant regions of cross section, while regions of high dislocation density ($\sim 5 \times 10^6/cm^2$) occur in bands in a number of places. Additional measurements of stress distributions in EFG material have been obtained at the University of Illinois using shadow-Moire interferometry.

50188 (GKSS—84/E/7) **Neutron induced irradiation damage in amorphous Fe40Ni40B20.** Schimansky, F.P. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.); Hamburg Univ. (Germany, F.R.). Fachbereich Chemie). 1984. 96p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE84752113.

Three different types of radiation damage have been identified in neutron-irradiated amorphous $Fe_{40}Ni_{40}B_{20}$: i) The generation of density fluctuations combined with a macroscopic swelling. ii) The radiation enhanced formation of amorphous $(Fe,Ni)_{75}B_{25}$-clusters in a correspondingly boron depleted matrix. iii) The production of helium bubbles; helium results from $^{10}B(n, \alpha)^7Li$ nuclear reactions. Radiation induced crystallization was not observed. The various types of radiation damage exert differing influences on the ductility of the amorphous $Fe_{40}Ni_{40}B_{20}$-ribbons. An additionally performed neutron irradiation of thermally crystallized $Fe_{40}Ni_{40}B_{20}$ revealed a partial re-amorphisation.

50189 (INIS-mf—9065, pp 1-2) **Interactions of MeV energy ion beams with solids.** Mitchell, I.V. (Royal Melbourne Inst. of Tech. (Australia)). Nov 1983. NTIS (US Sales Only), PC A10/MF A01. File Number TI84780622. (CONF-8311183—).

From 3. Australian conference on nuclear techniques of analysis; Lucas Heights, Australia (1 Nov 1983).

The use of MeV He ion beams as a method for quantitative near-surface analysis of solids is briefly noted. Work in ion channeling and ion scattering is considered.

50190 (INIS-mf—9065, pp 63-64) **Applications of channeling in ion beam analysis of crystals.** Williams, J.S. (Royal Melbourne Inst. of Tech. (Australia)). Nov 1983. NTIS (US Sales Only), PC A10/MF A01. File Number TI84780622. (CONF-8311183—).

From 3. Australian conference on nuclear techniques of analysis; Lucas Heights, Australia (1 Nov 1983).

The applications of channeling of high energy light ions in the analysis of crystals are reviewed. Topics treated include basic principles of channeling, measurements of crystal disorder and defects and measurement of atom location. Examples of representative applications are given.

50191 (INIS-mf—9065, pp 74-76) **Study of coherent precipitation of antimony in silicon using He^+ ion channeling and electron microscopy.** Short, K.T.; Pogany, A.P.; Williams, J.S. (Royal Melbourne Inst. of Tech. (Australia)). Nov 1983. NTIS (US Sales Only), PC A10/MF A01. File Number TI84780622. (CONF-8311183—).

From 3. Australian conference on nuclear techniques of analysis; Lucas Heights, Australia (1 Nov 1983).

Ion implantation of high doses ($> 10^{15}$ cm^{-2}) of antimony into silicon followed by annealing at >850 deg. C leads to the formation of semicoherent precipitates of Sb in Si. These structures have been studied extensively by He^+ ion channeling and transmission electron microscopy.

50192 (INIS-mf—9065, pp 77-79) **Measurements of disorder distributions in GaAs using He^+ ion channeling.** Rossiter, K.G.; Elliman, R.G.; Pogany, A.P.; Mitchell, I.V.; Williams, J.S. (Royal Melbourne Inst. of Tech. (Australia)). Nov 1983. NTIS (US Sales Only), PC A10/MF A01. File Number TI84780622. (CONF-8311183—).

From 3. Australian conference on nuclear techniques of analysis; Lucas Heights, Australia (1 Nov 1983).

High resolution Rutherford backscattering and channeling with MeV energy He^+ ions and transmission electron microscopy have been applied to a study of defect structures in ion implanted and annealed (100) GaAs. Results indicate a GaAs layer rich in twins in (111) planes. These twins are typically <20A thick and give rise to enhanced dechanneling of MeV He^+ ions which suggests significant residual lattice strain.

50193 (INIS-mf—9065, pp 154-161) **Low energy ion beam interaction with surfaces and the application to surface analysis.** MacDonald, R.J. (Newcastle Univ. (Australia). Dept. of Physics). Nov 1983. NTIS (US Sales Only), PC A10/MF A01. File Number TI84780622. (CONF-8311183—).

From 3. Australian conference on nuclear techniques of analysis; Lucas Heights, Australia (1 Nov 1983).

The application of low energy ion beams to the compositional and structural analysis of surfaces is reviewed. The methods of low energy ion scattering, secondary ion mass spectrometry and sputter induced photon spectroscopy are considered.

50194 (INIS-mf—9065, pp 162-165) **Surface structure analysis with LEIS.** O'Connor, D.J.; Higginbottom, P.R.; MacDonald, R.J. (Newcastle Univ. (Australia). Dept. of Physics). Nov 1983. NTIS (US Sales Only), PC A10/MF A01. File Number TI84780622. (CONF-8311183—).

From 3. Australian conference on nuclear techniques of analysis; Lucas Heights, Australia (1 Nov 1983).

A method of surface analysis which will uniquely define surface structure by low energy ion scattering while minimising the complications arising from charge exchange is reviewed.

50195 (INIS-SU—247, pp 188-193) **Method of light ion backscattering combined with channeling for analysis of radiation damage types in implanted gallium arsenide.** Tashlykov, I.S. 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. File Number TI84780555. (CONF-8205270—).

From 12. All-Union conference on physics of interaction between charged particles and crystals; Moscow, USSR (25 May 1982).

Results of investigations of different types of radiation-induced defects formed in (100) GaAs implanted with 50 keV Al^+ ions at room temperature, at 100 deg and 375 deg C, are discussed. The investigation is performed by the Rutherford backscattering of channeling ions with changing energy (He^+ energy is 0.6, 1.0, 1.4 and 2.0 MeV). The results of investigations given prove a higth efficiency of the above method for the analysis of radiative defect types in ion-implanted structures.

50196 (INIS-SU—247, pp 28-33) **Resonant dechanneling of hundreds keV hydrogen and helium ions at axial-plane transitions in silicon.** Bulgakov, Yu.V.; Lenkajt, K. 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. File Number TI84780555. (CONF-8205270—).

From 12. All-Union conference on physics of interaction between charged particles and crystals; Moscow, USSR (25 May 1982).

Experimental results on monocrystalline silicon film irradiation with 180-350 keV hydrogen- and 500-700 keV helium ions are discussed. Transparency coefficient, the number of dechanneled ions and energy distribution of ions that have passed through the target, are determined. The experimental results prove the existence of the resonance dechanneling effect at the axial-to-planar <11g>-(110) transition.

50197 (INIS-SU—247, pp 101-103) **Emission spectrum at electron plane channeling with account for dechanneling and collimation.** Bajer, V.N.; Katkov, V.M.; Strakhovenko, V.M. 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. File Number TI84780555. (CONF-8205270—).

From 12. All-Union conference on physics of interaction between charged particles and crystals; Moscow, USSR (25 May 1982).

A mathematical model of radiation spectrum in the case of electron planar channeling is suggested with respect to dechanneling and collimation. The comparison of results obtained according to the above technique and by way of experiments gives a good coincidence with respect to maxima position and according to the qualitative behaviour of spectra of electron radiation.

50198 (INIS-SU—247, pp 137-142) **Investigation of semiconductor materials proton damage by radiography.** Gajst, F.; Stefan, D.; Otto, G. 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. File Number TI84780555. (CONF-8205270—).

From 12. All-Union conference on physics of interaction between charged particles and crystals; Moscow, USSR (25 May 1982).

The application of the topographic Berg-Barrett method, method of registration of curves of diffraction reflection in the Bragg geometry and the Auletner method of inverse scattering for the study of weak lattice defects that appear during proton radiation of GaAs, GaP and Si monocrystals, is considered. Irradiation is performed at room temperature at proton energy of 1 MeV, dose range is $1.6x10^{14}$-$6.5x10^{17}$ cm^{-2}. The first method gives the general information relative to the degree of crystal damage. The second method (according to Auletner) gives the possibility of simultaneous determination of the value of lattice deformation for the whole range of doses. The method is non-destructive and simple. The use of this method for GaAs investigation irradiated by protons has shown that the spectrum of lattice distortion increases with dose and achieves a high value. At the same time the sample remains monocrystalline.

50199 (INIS-SU—247, pp 180-182) **Residual damage in GaAs annealed layers bombarded by silicon ions.** Sorvina, V.P.; Tetel'baum, D.I.; Shilova, M.V. 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. File Number TI84780555. (CONF-8205270—).

From 12. All-Union conference on physics of interaction between charged particles and crystals; Moscow, USSR (25 May 1982).

To specify the saturation nature (high charge carrier density) photoconductivity and its spectral dependence for GaAs samples irradiated with 40 keV SiH_2 of different doses from $6x10^{13}$ ion/cm^2, target temperatures during implantation (20, 250, 300, 350 deg C) and annealing temperatures, are measured. Semiinsulating GaAs with (110) orientation is used. Annealing after irradiation is performed in the mixture of graphite powder with refined gallium arsenide for 15 min. It is shown that saturation effect during silicon implantation is connected with accumulation of hardly annealed defects and possibly, with the accumulation of compensation SiAs centres.

50200 (INIS-SU—247, pp 143-156) **Investigation of laser and electron induced recrystallization of silicon layers by means of channeling techniques.** Glaser, E.; Jehn, U. 1983. NTIS (US Sales Only), PC A11/MF A01. File Number TI84780555. (CONF-8205270—).

From 12. All-Union conference on physics of interaction between charged particles and crystals; Moscow, USSR (25 May 1982).

The method of gallium ions (1,4 and 2 MeV) channeling has been used to investigate recrystallization of surface silicon layers in liquid and solid states under laser and electron radiations. Surface layers were previously amorphized by implanting As, Sb, P, Ar, Au ions with the energy 65-200 keV. The epitaxial growth of crystals, in both solid and liquid phases is observed. During recrystallization from liquid phase, the formation of perfect double plates takes place. It is shown that in recrystallized layers, polycrystals exist along with monocrystallized sections. It is noted, that in the process of melt recrystallization two processes can take place: redistribution of implanted admixture atoms or their cluster on the moving crystallization front. In the case of admixture concentration lower than Csub(cr), the nonequilibrium liquid phase epitaxy is possible when addition ions occupy lattice nodes due to which their concentration exceeds the value of maximum equilibrium solubility (supersolubility effect).

50201 (KFKI—1983-106) **Pinning of charge density waves by irradiation induced defects in orthorhombic TaS_3.** Mihaly, G.; Mihaly, L.; Mutka, H. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Oct 1983. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703106.

The effects of electron irradiation induced damage on dc conductivity, threshold field and complex dielectric constant of TaS_3 crystals at 9 GHz are investigated in a wide temperature range. Whereas the single particle gap in the low temperature phase is not influenced by irradiation, transport properties associated with collective excitation of charge density waves (CDW) are sensitive to the presence of new pinning centres. The results are discussed in the framework of the semiclassical model of Gruener, Zawadowski and Chaikin. The pinning frequency determined from the threshold field agrees well with that calculated from the complex dielectric constant.

50202 (LA-UR—84-2994) **New phases and chemical reactions in solid CO under pressure.** Mills, R.L.; Schiferl, D.; Katz, A.I.; Olinger, B.W. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 6p. (CONF-8409145—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85002033.

From International colloquium on the physics and physicochemistry of highly condensed matter; Auossis, France (11 Sep 1984).

The phase diagram of solid carbon monoxide was determined by x-ray diffraction and Raman spectroscopy from 15 to 297 K at pressures from 1.0 to 10.0 GPa. At low temperature a transition occurs near 3.4 GPa from the known α-phase (space group $P2_13$) to a new ϵ-phase (structure unknown), rather than to the predicted γ-phase ($P4_2/mnm$). A transformation from β-CO (space group $P6_3/mmc$) into a new δ-phase ($Pm3n$) was found near 5.2 GPa at room temperature. Above about 4.6 GPa and 80 K, CO reacts photochemically when irradiated with visible laser light. The photoreactivity may be associated with the formation of a yellow polymer, which can be recovered at zero pressure. ESCA measurements indicate that the polymer is composed of carbon suboxide (C_3O_2)/sub x/. 19 references.

50203 (LBL—18276) **Subnanosecond time-resolved emission study of Cu_2O and GaAs.** Weiner, J.S. (Lawrence Berkeley Lab., CA (USA)). Aug 1984. Contract AC03-76SF00098. 119p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85002070.

This thesis presents a series of time-resolved luminescence and light scattering experiments which are aimed at studying how nonequilibrium electron-hole populations excited by picosecond laser pulses in semiconductors reach equilibrium. The development of a time-delayed coincidence photon counting system for the time-dependent measurements is described, and this system is tested by measuring the photoexcited free carrier lifetimes in GaAs doped with deep impurities. The bulk of this thesis is devoted to the study of the dynamics of excitons in Cu_2O. We first develop a model to explain quantitatively the lineshape of nonthermalized luminescence spectra in Cu_2O which have been obtained with continuous wave lasers. Then we measure the time-dependence of the ortho-exciton and para-exciton populations in Cu_2O as a function of temperature. We demonstrate conclusively that the orthoexciton lifetime is dominated by its decay into the para-exciton, and furthermore, this decay rate increases with temperature as T/sup 3/2/. As a result, at low temperatures the ortho-excitons and para-excitons are not in thermal equilibrium, but at $T > \sim 40$ °K the two exciton systems reach thermal equilibrium almost instantaneously. We also studied the time-dependence of both one-phonon and two-phonon Raman modes when resonantly enhanced at the ortho-exciton in Cu_2O, and found from their time-dependence that these modes should be more correctly identified as hot luminescence. We conclude that time-dependent light scattering and emission measurement is a technique which is capable of greatly improving our knowledge about dynamic processes occurring not only in condensed matter, but, in principle, also in molecular and biological systems. 17 references.

50204 (N—84-20858) **Frictional and morphological properties of Au-MoS2 films sputtered from a compact target.** Spalvins, T. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Apr 1984. 19p. (NASA-TM—83604; E—2004; CONF-8403133—1). NTIS, PC A02/MF A01.

From 11. international conference on metallurgical coatings; San Diego, CA, USA (9 Apr 1984).

AuMoS2 films 0.02 to 1.2 microns thick were sputtered from target compacted from 5 wt % Au + 95 wt % MoS2, to investi-

gate the frictional and morphological film growth characteristics. The gold dispersion effects in MoS2 films are of interest to increase the densitification and strengthening of the film structure. Three microstructural growth stages were identified on the nano-micro-macrostructural level. During sliding both sputtered Au-MoS2 and MoS2 films have a tendency to break within the columner region. The remaining or effective film, about 0.2 microns thick, performs the lubrication. The Au-MoS2 films displayed a lower friction coefficient with a high degree of frictional stability and less wear debris generation as compared to pure MoS2 films. The more favorable frictional characteristics of the Au-MoS2 films are attributed to the effective film thickness and the high density packed columner zone which has a reduced effect on the fragmentation of the tapered crystallites during fracture.

50205 **(NP—4770516) Process-included topological changes of monocrystalline silicon plates.** Gellrich, N. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Elektrotechnik). 25 Jan 1983. 112p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE84770516.

The thesis investigates stresses in coatings of thermal SiO_2, sputtered SiO_2, poly-silicon and Si_3N_4. For thermally deposited Si the tensions are the result of differing linear thermal expansion, but in the other materials also intrinsic stresses are found which are produced during deposition. The physical origin of these stresses is investigated.

50206 **Quantum size effects in GaAs/GaAs/sub x/P_1/sub -x/ strained-layer superlattices.** Gourley, P.L.; Biefeld, R.M. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Applied Physics Letters;* **45**: No. 7, 749-751(1 Oct 1984). Contract AC04-76DP00789.

We report the first observations of quantum size effects in GaAs/GaAs/sub 0.5/P/sub 0.5/ strained-layer superlattices (SLS's). Using excitation and photoluminescence spectroscopies, we have observed optical transitions between excited states of the electron and hole quantum wells. These observations provide a measure of the biaxial compressive strain in the GaAs layers, interfacial roughness, and valence-band offset for the GaAs/GaP heterojunction.

50207 **Elastic constants of plastic crystals by Schaefer-Bergmann scattering.** Marx, S.V.; Simmons, R.O. (Department of Physics and Materials Research Laboratory, University of Illinois at Urbana—Champaign, Urbana, Illinois 61801). *Review of Scientific Instruments;* **55**: No. 10, 1620-1624(Oct 1984). Contract AC02-76ER01198.

A Schaefer—Bergmann technique for ultrasonic sound velocity measurements on single crystals has been developed for use with substances which are either gas or liquid at room temperature. The advantages of this method for measuring elastic constants of such crystals are discussed. A method for simultaneously determining the elastic constants and the spatial orientation of the crystal from the light scattering data is presented.

50208 **Diffusion of deuterium and hydrogen in rutile TiO_2 crystals at low temperatures.** Chen, Y.; Gonzalez, R.; Tsang, K.L. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Physical Review Letters;* **53**: No. 11, 1077-1079(10 Sep 1984). Contract AC05-84OR21400.

It is demonstrated that diffusion of deuterons and protons in crystalline rutile, TiO_2, can be induced near room temperature by breaking of the O-H bond with electron irradiation and sweeping of these hydrogenic species along the c axis by an electric field.

50209 **High voltage variable diameter insulator.** Vanecek, D.L.; Pike, C.D. (to Dept. of Energy). US Patent 4,459,430. 10 Jul 1984. Filed date 13 Jul 1982. vp.

PAT-APPL-397736.

A high voltage feedthrough assembly (10) having a tubular insulator (15) extending between the ground plane ring (16) and the high voltage ring (30). The insulator (15) is made of Pyrex and decreases in diameter from the ground plane ring (16) to the high voltage ring (30), producing equipotential lines almost perpendicular to the wall (27) of the insulator (15) to optimize the voltage-holding capability of the feedthrough assembly (10).

50210 **Electron-stimulated desorption from partially fluorinated hydrocarbon thin films: Molecules with common versus separate hydrogen and fluorine bonding sites.** Kelber, J.A.; Knotek, M.L. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Physical Review [Section] B: Condensed Matter;* **30**: No. 1, 400-403(1 Jul 1984). Contract AC04-76DP00789.

We have observed H^+ and F^+ yields as a function of low-energy (10—100 eV) electron bombardment from thin films of solid nonafluoroisobutane [$(CF_3)_3CH$], 1,2,3,5-tetrafluorobenzene ($C_6H_2F_4$), 1-fluorobutane (C_4H_9F), and fluorocyclohexane ($C_6H_{11}F$). For the materials with separate H and F bonding sites [$C_6H_2F_4$ and $(CF_3)_3CH$], H^+ and F^+ have different appearance potentials, corresponding, respectively, to excitations of the C 2s and F 2s levels (~25 and ~40 eV). For the materials with common H and F bonding sites, the H^+ and F^+ appearance potentials correspond to excitation of the C 2s level. The F^+ threshold is relatively weak, and a steep increase in the F^+ yield is observed near 40 eV (F 2S excitation). These results indicate that the final-state excitations leading to ion desorption in these systems are localized within functional groups but not necessarily within individual C—H or C—F bonds of the functional group.

50211 **Chemically durable nitrogen containing phosphate glasses useful for sealing to metals.** Day, D.E.; Wilder, J.A. Jr. (to Dept. of Energy). US Patent 4,455,384. 19 Jun 1984. Filed date 8 Dec 1982. vp.

PAT-APPL-447847.

The chemical durability of alkali phosphate glasses is improved by incorporation of up to 23 weight percent of nitrogen. A typical phosphate glass contains: 10 to 60 mole % of Li_2O, Na_2O or K_2O; 5-40 mole % of BaO or CaO; 0-1 to 10 mole % of Al_2O_3; and 40-70 mole % of P_2O_5. Nitrides, such as AlN, are the favored additives.

50212 **Josephson-type oscillations in a moving charge-density wave interacting with magnetic impurities.** Tua, P.F.; Zawadowski, A.; Ruvalds, J. (Department of Physics, University of Virginia, Charlottesville, Virginia 22901). *Physical Review [Section] B: Condensed Matter;* **29**: No. 12, 6525-6529(15 Jun 1984). Contract AS05-81ER10959.

The theory of Josephson-type oscillations in a moving charge-density wave proposed by Barnes and Zawadowski is extended to include the interaction with spin-1/2 magnetic impurities in the presence of a constant magnetic field. The current oscillations of the Josephson type are found to exhibit a magnetic field dependence providing that the conduction electron and impurity g factors are different. This effect could be used experimentally to distinguish between classical and Josephson-type contributions to the narrow-band noise in materials such as $NbSe_3$ and TaS_3 doped with magnetic impurities.

50213 **Transport properties of n-type metalorganic chemical-vapor-deposited Al/sub x/Ga/sub 1-x/As (0< or =x< or =0.6).** Bhattacharya, P.K.; Das, U.; Ludowise, M.J. (Department of Electrical and Computer Engineering, Oregon State University, Corvallis, Oregon 97331). *Physical Review [Section] B: Condensed Matter;* **29**: No. 12, 6623-6631(15 Jun 1984). Contract AT06-81ER10939.

Temperature-dependent measurements in the range 20< or =T< or =600 K have been made on undoped and Si-doped metalorganic chemical-vapor-deposition—grown Al/sub x/Ga/sub 1-x/As (0< or =x< or =0.6) on GaAs. Data obtained from Hall and high-field measurements with the use of the probe technique have been analyzed. The transport parameters in the samples have been obtained from analysis of data and the relative importance of the various scattering mechanisms in different composition ranges have been elucidated. It is found that space-charge scattering plays an important role in limiting electron mobility at 300 K for 0<x< or =0.3, and intervalley scattering plays the dominant role in the composition range 0.3< or =x< or =0.5. Donor levels, with their activation energy E/sub D/ increasing with x up to 0.133 eV at x = 0.35, are present in the undoped samples. The dominant donor level in the Si-doped samples also exhibits a similar trend, with E/sub D/ = 0.095 eV for x = 0.35. High values of drift velocity in

samples with x> or =0.4 at 300 K and similar features observed in some samples with x<0.4 at high temperatures have been attributed to electron transfer from the substrate to the epitaxial layers.

50214 **Carbon particles.** Hunt, A.J. (to Dept. of Energy). US Patent 4,452,771. 5 Jun 1984. Filed date 29 Sep 1982. vp.

PAT-APPL-426369.

A method and apparatus whereby small carbon particles are made by pyrolysis of a mixture of acetylene carried in argon. The mixture is injected through a nozzle into a heated tube. A small amount of air is added to the mixture. In order to prevent carbon build-up at the nozzle, the nozzle tip is externally cooled. The tube is also elongated sufficiently to assure efficient pyrolysis at the desired flow rates. A key feature of the method is that the acetylene and argon, for example, are premixed in a dilute ratio, and such mixture is injected while cool to minimize the agglomeration of the particles, which produces carbon particles with desired optical properties for use as a solar radiant heat absorber.

50215 **Method for depositing a uniform layer of particulate material on the surface of an article having interconnected porosity.** Wrenn, G.E. Jr.; Lewis, J. Jr. (to Dept. of Energy). US Patent 4,452,832. 5 Jun 1984. Filed date 29 Sep 1982. vp.

PAT-APPL-426364.

The invention is a method for depositing liquid-suspended particles on an immersed porous article characterized by interconnected porosity. In one form of the invention, coating is conducted in a vessel containing an organic liquid supporting a colloidal dispersion of graphite sized to lodge in surface pores of the article. The liquid comprises a first volatile component (e.g., acetone) and a second less-volatile component (e.g., toluene) containing a dissolved organic graphite-bonding agent. The liquid also contains an organic agent (e.g., cellulose gum) for maintaining the particles in suspension. A porous carbon article to be coated is immersed in the liquid so that it is permeated therewith. While the liquid is stirred to maintain a uniform blend, the vessel headspace is evacuated to effect flashing-off of the first component from the interior of the article. This causes particle-laden liquid exterior of the article to flow inwardly through its surface pores, lodging particles in these pores and forming a continuous graphite coating. The coated article is retrieved and heated to resin-bond the graphite. The method can be used to form a smooth, adherent, continuous coating of various materials on various porous articles. The method is rapid and reproductible.

50216 **Method for incorporating radioactive phosphoric acid solutions in concrete.** Wolf, G.A.; Inle, N.C.; Smith, J.W. (to Dept. of Energy). US Patent 4,442,028. 10 Apr 1984. Filed date 8 Jul 1982. vp.

PAT-APPL-396192.

A method for incorporating radioactive phosphoric acid solutions in concrete is described wherein the phosphoric acid is reacted with $Ca(OH)_2$ to form a precipitate of hydroxyapatite and the hydroxyapatite is mixed with portland cement to form concrete.

50217 **Ising model simulations of impurity trapping in silicon.** Gilmer, G.H. (Bell Laboratories, Murray Hill, New Jersey 07974). pp 249-261 of Laser solid interactions and transient thermal processing of materials. Narayan, J.; Brown, W.L.; Lemons, H.A. Amsterdam, Netherlands; Elsevier Science Publishing (1983). (CONF-8211153—).

From MRS symposium on laser-solid interactions and transient thermal processing of materials; Boston, MA, USA (1 Nov 1982).

Laser annealing experiments on silicon have shown that rapid solidification can trap large amounts of certain impurities in the crystal lattice. Concentrations that exceed the equilibrium solubility limits by several orders of magnitude have been obtained. In this paper the authors discuss the impurity trapping process using Monte Carlo simulation data from the kinetic Ising model. The dependence of the impurity concentration in the crystal on the solidification rate is calculated. The simulation data are compared with recent laser annealing results for bismuth and indium. Excellent agreement between the model and the bismuth experiments is obtained. The larger trapping rate on the (111) relative to the (100) orientation is found to be caused by the slower crystallization kinetics on the (111) face. Similar results are obtained for indium, although the difference in trapping on the (111) and (100) faces is somewhat smaller in the model than in the experiment.

50218 **Microprobe Raman analysis of picosecond laser annealing of implanted silicon.** Sapriel, J.; Nissim, Y.I.; Oudar, J.L. (Centre National d'Etudes des Telecommunications, 196 rue de Paris 92220 BAGNEUX). pp 235-240 of Laser solid interactions and transient thermal processing of materials. Narayan, J.; Brown, W.L.; Lemons, H.A. Amsterdam, Netherlands; Elsevier Science Publishing (1983). (CONF-8211153—).

From MRS symposium on laser-solid interactions and transient thermal processing of materials; Boston, MA, USA (1 Nov 1982).

Picosecond laser annealing has been performed on implantation-amorphised silicon. A multiannular (up to five rings) recrystallization pattern has been generated by a single about30 psec pulse at 1.06 μm and 0.53 μm wavelength and energy density just below the damage threshold. The different patterns have been investigated by scanning the surface with a Raman microprobe with a 1μm spacial resolution. Information are thus given on the different phases (amorphous or crystalline) and on lateral as well as in depth dimensions of the different rings.

50219 **Aligned, coexisting liquid and solid regions in pulsed and cw laser annealing of Si.** Nemanich, R.J.; Biegelson, D.K.; Hawkins, W.G. (Xerox Palo Alto Center, Palo Alto, CA 94304). pp 211-236 of Laser solid interactions and transient thermal processing of materials. Narayan, J.; Brown, W.L.; Lemons, H.A. Amsterdam, Netherlands; Elsevier Science Publishing (1983). (CONF-8211153—).

From MRS symposium on laser-solid interactions and transient thermal processing of materials; Boston, MA, USA (1 Nov 1982).

Aligned, coexisting liquid and solid regions are observed in cw laser annealing of polycrystalline Si films on quartz substrates. These stripe patterns are the precursors of surface topography that exists after cooling. It is proposed that a similar situation exists in the pulse annealing process. A calculation of the temperature evolution which assumes stripe symmetry and kinetic restraints of the crystallization process has been carried out. These calculations indicate a lattice temperature of between 1100 and 1300 K, 10 nsec after the sample has fully solidified.

50220 **Amorphous Si, crystallization and melting.** Poate, J.M. (Bell Laboratories, Murray Hill, New Jersey 07974). pp 263-271 of Laser solid interactions and transient thermal processing of materials. Narayan, J.; Brown, W.L.; Lemons, H.A. Amsterdam, Netherlands; Elsevier Science Publishing (1983). (CONF-8211153—).

From MRS symposium on laser-solid interactions and transient thermal processing of materials; Boston, MA, USA (1 Nov 1982).

Recent experiments dealing with the thermodynamics of crystallization and melting of amorphous Si are reviewed. Differential scanning calorimetry measurements give the heat of crystallization of implanted, amorphous Si to be 11.3 + or - .8 kJ/mole. Gibbs free energy calculation based on these measurements indicate that amorphous Si melts at a temperature of 1460°K compared to the crystalline value of 1685°K. Evidence for this reduced melting temperature also comes from rapid heating measurements using a) structural information after solidification and b) dynamic conductance measurements during the melt. Solid phase epitaxial regrowth experiments which apparently do not show such a depression in amorphous melting temperature are discussed.

50221 **Impurity redistribution in ion implanted Si after picosecond Nd laser pulse irradiation.** Campisano, S.U.; Baeri, P.; Malvezzi, A.M.; Rimini, E.; Russo, G. (Istituto di Fisica, 57 Corso Italia I 95129 Catania). pp 273-279 of Laser solid interactions and transient thermal processing of materials. Narayan, J.; Brown, W.L.; Lemons, H.A. Amsterdam, Netherlands; Elsevier Science Publishing (1983). (CONF-8211153—).

From MRS symposium on laser-solid interactions and transient thermal processing of materials; Boston, MA, USA (1 Nov 1982).

Impurity redistribution in Bi-implanted Si and in As-implanted Si has been investigated after irradiation with 25 ps Nd(λ=1.06 μ) laser pulse in the energy range 0.1-1.5 J/cm^2. Channeling effect in combination with 2.0 MeV He+ backscattering in glancing detection has been used to characterize the epitaxial crystallization, the impurity location and its depth distribution. The amorphous to single crystal transition occurs at an energy density of about 0.4 J/cm^2. Bi atoms are located after crystallization in substitutional lattice sites for the in depth part of the distribution. Part of the Bi atoms accumulated at the sample surface and the amount of segregation increases with the pulse energy density and depends on the substrate orientation. A computer model has been also developed to calculate several parameters of interest, as the melt threshold, the melt duration, the carrier temperature etc including a detailed description of the absorption and of the energy relaxation processes. The calculations indicate that the simple thermal description accounts quantitatively for the experimental data on melt duration and impurity segregation.

50222 **Impurity distribution profiles and surface disorder after laser induced diffusion.** Fogarassy, E.; Broutet, F.; Siffert, P.; Stuck, R. (Laboratoire PHASE, 67037 Strasbourg CEDEX). pp 311-316 of Laser solid interactions and transient thermal processing of materials. Narayan, J.; Brown, W.L.; Desoyer, J.C.; Lemons, H.A. Amsterdam, Netherlands; Elsevier Science Publishing (1983). (CONF-8211153—).

From MRS symposium on laser-solid interactions and transient thermal processing of materials; Boston, MA, USA (1 Nov 1982).

A model for laser induced diffusion is proposed, assuming the melting of Si surface under pulsed laser irradiation and the diffusion, in liquid phase, of /SUP a/ thin film of impurity deposited according to the "limited source" conditions. Depending on the thickness of the film, it results in a dopant distribution profile with a surface disordered layer induced either by segregation effects or precipitation of the dopant in excess of the solubility limit achieved by laser annealing. Experimental results, obtained for a ruby laser irradiation of thin films of different impurities of group III and V, like antimony, bismuth, gallium and indium deposited on silicon substrates are in good agreement with the model. Their effective segregation coefficients have been deduced by fitting the experimental amount of dopant precipitated in the disordered surface layer with the numerical calculations. A cellular structure is seen on surface.

50223 **Measurement of fast melting and regrowth velocities in picosecond laser heated silicon.** Bucksbaum, P.H.; Bokor, J. (Bell Telephone Laboratories, Holmdel, New Jersey). pp 31-56 of Laser solid interactions and transient thermal processing of materials. Narayan, J.; Brown, W.L.; Lemons, H.A. Amsterdam, Netherlands; Elsevier Science Publishers (1983). (CONF-8211153—).

From MRS symposium on laser-solid interactions and transient thermal processing of materials; Boston, MA, USA (1 Nov 1982).

Fast regrowth of amorphous silicon from liquid silicon films has been directly observed in a time resolved picosecond laser melting experiment. Liquid films up to 100 nm thick were formed on crystalline substrates with 15 picosecond 248 nm pulses from a KrF* excimer laser. The film thickness as a function of time was probed directly by observing attenuation of 1.64 μm 15 psec light pulses transmitted through the melt. Melting and regrowth velocities were compared to a heat diffusion model, and evidence for melt undercooling was observed. The resolidified silicon was amorphous at all values of incident laser intensity.

50224 **Beam shaping for CW laser recrystallization of polysilicon films.** Zorabedian, P.; Cass, T.R.; Drowley, C.I.; Kamins, T.I. (Hewlett-Packard Laboratories, 3500 Deer Creek Road, Palo Alto, CA 94304). pp 523-528 of Laser solid interactions and transient thermal processing of materials. Narayan, J.; Brown, W.L.; Lemons, H.A. Amsterdam, Netherlands; Elsevier Science Publishing (1983). (CONF-8211153—).

From MRS symposium on laser-solid interactions and transient thermal processing of materials; Boston, MA, USA (1 Nov 1982).

A shaped laser beam has been used for laterally seeded recrystallization of polysilicon films over oxide. Direct maps of the shaped-beam intensity distribution in the wafer plane are correlated with the grain structure of the recrystallized polysilicon. Using 60% overlapping of shapedbeam scans along <100> directions, the authors obtained seeded areas one mm wide and 50 to 500μm long. These consist of 40μm-wide adjacent single-crystal strips regularly separated by low-angle grain boundaries extending laterally away from the seed openings. The spacing between grain boundaries is equal to the scan spacing, providing a means for controlling the location of grain boundaries in otherwise defect-free, single-crystal films.

50225 **A comparison of CW laser and electron-beam recrystallization of polysilicon in multilayer structures.** Crowley, C.I.; Hu, C. (Hewlett-Packard Laboratories, 3500 Deer Creek Road, Palo Alto, CA 94304). pp 529-534 of Laser solid interactions and transient thermal processing of materials. Narayan, J.; Brown, W.L.; Lemons, H.A. Amsterdam, Netherlands; Elsevier Science Publishing (1983). (CONF-8211153—).

From MRS symposium on laser-solid interactions and transient thermal processing of materials; Boston, MA, USA (1 Nov 1982).

A thermal model for beam-induced melting of polysilicon in polysilicon/insulator/silicon structures has been used to compare CW Ar^+ laser and electron-beam melting processes. The laser melting process exhibits a decreasing recrystallization threshold power and an increasing substrate melting threshold power with increasing insulator thickness. The decrease in recrystallization threshold with increasing insulator thickness is generally smaller for electron beams because of their deep penetration. The substrate melting threshold is approximately independent of insulator thickness for e-beams since no change in the power absorption occurs on melting of the polysilicon. As a result, the process window between the onset of recrystallization and melting of the substrate is narrower for e-beams than for laser beams. Also, essentially no window will exist between the onset of melting over a seed and substrate melting under an oxide if lateral epitaxy is performed with an electron beam.

50226 **Laser-induced crystallization of silicon on bulk amorphous substrates: An overview.** Biegelsen, D.K.; Fennell, L.E.; Hawkins, W.G.; Johnson, N.M.; Moyer, M.D. (Xerox Palo Alto Research Centers, Palo Alto, CA 94304). pp 537-548 of Laser solid interactions and transient thermal processing of materials. Narayan, J.; Brown, W.L.; Lemons, H.A. Amsterdam, Netherlands; Elsevier Science Publishing (1983). (CONF-8211153—).

From MRS symposium on laser-solid interactions and transient thermal processing of materials; Boston, MA, USA (1 Nov 1982).

In this paper the authors review the current understanding of laser-induced silicon thin film crystal growth on bulk amorphous substrates. A model is proposed for oriented nucleation and show that the silicon reflectivity jump on melting coupled with radiant heating lead naturally to this autonucleation mechanism. A survey is then given of various techniques for control of lateral epitaxial growth and conclude with the results of some recent electrical device characterization.

50227 The effects of selectively absorbing dielectric layers and beam shaping on recrystallization and FET characteristics in laser recrystallized silicon on amorphous substrates. Possin, G.E.; Chiang, S.W.; Liu, Y.S.; Parks, H.G. (General Electric Research and Development Center Schenectady, New York 12301). pp 549-556 of Laser solid interactions and transient thermal processing of materials. Narayan, J.; Brown, W.L.; Lemons, H.A. Amsterdam, Netherlands; Elsevier Science Publishing (1983). (CONF-8211153—).

From MRS symposium on laser-solid interactions and transient thermal processing of materials; Boston, MA, USA (1 Nov 1982).

Selective absorption, using patterned dielectric films, and beam shaping were used as means for improving the recrystallization of LPCVD polysilicon islands on fused quartz. IR imaging of the laser heated region was used to optimize and control the recrystallization. MOSFETs were fabricated in laser-recrystallized silicon islands on amorphous substrates using a standard n-channel polygate process. Devices with various channel lengths and widths were fabricated, and the dependence of threshold voltage, channel mobility, and leakage on recrystallization conditions and device dimensions was studied.

50228 Growth of silicon-on-insulator films using a line-source electron beam. Knapp, J.A.; Picraux, S.T. (Sandia National Laboratories, Albuquerque, New Mexico 87185). pp 557-562 of Laser solid interactions and transient thermal processing of materials. Narayan, J.; Brown, W.L.; Lemons, H.A. Amsterdam, Netherlands; Elsevier Science Publishing (1983). (CONF-8211153—).

From MRS symposium on laser-solid interactions and transient thermal processing of materials; Boston, MA, USA (1 Nov 1982).

A swept line-source electron beam has been used to study unseeded Si-oninsulator crystallization at beam scan speeds of 150-1500 cm/s. For a particular sample configuration a maximum linear crystallization velocity of about 350 cm/s was observed. At higher sweep speeds, competing nucleation occurred at intervals across the film. Both the limit in crystallization velocity and the intervals between nucleation are tentatively explained by a simple model.

50229 Lateral epitaxial growth of thick polysilicon films on oxidized 3-inch wafers. Celler, H.K.; Leschner, D.J.; Robinson, McD.; Sheng, T.T. (Bell Laboratories, Murray Hill, New Jersey 07974). pp 575-580 of Laser solid interactions and transient thermal processing of materials. Narayan, J.; Brown, W.L.; Lemons, H.A. Amsterdam, Netherlands; Elsevier Science Pub. (1983). (CONF-8211153—).

From MRS symposium on laser-solid interactions and transient thermal processing of materials; Boston, MA, USA (1 Nov 1982).

It was recently reported the first successful crystallization from the melt of 15μm thick Si films on SiO_2. In this technique of Lateral Epitaxial Growth over Oxide (LEGO), crystallization is initiated at seeding vias in SiO_2 and propagates over the amorphous insulator, resulting in high structural quality of the grown film. Uniform and bow-free crystallization of complete 3-inch wafers occurs in <60 sec in a special furnace, with wafers placed between a bank of high intensity tungsten halogen lamps and a water cooled base. In this paper the authors provide further details of crystallization procedure and new structural characterization data. The mechanism of LEGO crystallization and its limitations are also discussed.

50230 Crystallization of silicon films on glass: A comparison of methods. Lemons, R.A.; Bosch, M.A.; Herbst, D. (Los Alamos National Laboratory, MS D429, Los Alamos, NM 87545). pp 581-592 of Laser solid interactions and transient thermal processing of materials. Narayan, J.; Brown, W.L.; Lemons, H.A. Amsterdam, Netherlands; Elsevier Science Pub. (1983). (CONF-8211153—).

From MRS symposium on laser-solid interactions and transient thermal processing of materials; Boston, MA, USA (1 Nov 1982).

The lure of flat panel displays has stimulated much research on the crystallization of silicon films deposited on large-area transparent substrates. In most respects, fused quartz is ideal. It has high purity, thermal shock resistance, and a softening point above the silicon melting temperature. Unfortunately, fused quartz has such a small thermal expansion that the silicon film cracks as it cools. This problem has been attacked by patterning with islands or moats before and after crystallization, by capping, and by using silicate glass substrates that match the thermal expansion of silicon. The relative merits of these methods are compared. Melting of the silicon film to achieve high mobility has been accomplished by a variety of methods including lasers, electron beams, and strip heaters. For low melting temperature glasses, surface heating with a laser or electron beam is essential. Larger grains are obtained with the high bias temperature, strip heater techniques. The low angle grain boundaries characteristic of these films may be caused by constitutional undercooling. A model is developed to predict the boundary spacing as a function of scan rate and temperature gradient.

50231 Electrical characteristics and device applications of zone-melting-recrystallized Si films on SiO_2. Tsaur, B.Y.; Brueck, S.R.J.; Chapman, R.L.; Fan, J.C.C.; Geis, M.W. (Lincoln Laboratory, Massachusetts Institute of Technology, Lexington, Massachusetts 02173). pp 593-603 of Laser solid interactions and transient thermal processing of materials. Narayan, J.; Brown, W.L.; Lemons, H.A. Amsterdam, Netherlands; Elsevier Science Pub. (1983). (CONF-8211153—).

From MRS symposium on laser-solid interactions and transient thermal processing of materials; Boston, MA, USA (1 Nov 1982).

Device-quality Si films have been prepared by using graphite strip heaters for zone melting poly-Si films deposited on SiO_2-coated substrates. The electrical characteristics of these films have been studied by the fabrication and evaluation of thin-film resistors, MOSFETs and MOS capacitors. High yields of functional transistor arrays and ring oscillators with promising speed performance have been obtained for CMOS test circuit chips fabricated in recrystallized Si films on 2-inch-diameter Si wafers. Dualgate MOSFETs with a three-dimensional structure have been fabricated by using the zone-melting recrystallization technique.

50232 Pulsed electron beam annealing induced deep level defects in virgin silicon. Barbier, D.; Chantre, A.; Kechouane, M.; Laugier, A. (INSA de Lyon, Laboratoire de Physique de la Matiere, Bat. 502, 20 Avenue A. Einstein 69621 VILLEURBANNE CEDEX). pp 449-454 of Laser solid interactions and transient thermal processing of materials. Narayan, J.; Brown, W.L.; Lemons, H.A. Amsterdam, Netherlands; Elsevier Science Publishing (1983). (CONF-8211153—).

From MRS symposium on laser-solid interactions and transient thermal processing of materials; Boston, MA, USA (1 Nov 1982).

DLTS has been used to investigate deep level defects induced by Pulsed Electron Beam Annealing (PEBA) in virgin (100) boron doped silicon. Various PEBA conditions were selected resulting in different molten layer thicknesses, melt front velocities and thermal gradient distributions. Discrete hole traps distributed in the regrowth layer were observed in all the annealed samples. The activation energies and thermal signatures of these levels do not correspond to already known defects except for one level which has been assigned to the carbon interstitial substitutional pair. Carbon contamination during irradiation is the most probable explanation for the creation of this defect. Other discrete hole trap levels are likely to be generated by quenching of the molten layer as far as their profiles do not extend beyond the regrowth layer. Moreover, a broad band of levels, characteristic of extended defects, has been observed only on the samples which have suffered the highest thermal stresses. This band of levels might be related to the generation of dislocation networks as recently observed by means of T.E.M. on the same PEBA processed samples.

50233 Crystallization of amorphous silicon films by pulsed ion beam annealing. Gyuali, J.; Fastow, R.; Hewett, C.A.; Kavanagh, K.; Mayer, J.W.; Palmstrom, C.J.; Thompson, M.O. (Department of Materials Science, Cornell University, Ithaca, NY 14853). pp 455-460 of Laser solid interactions and transient thermal processing of materials. Narayan, J.; Brown, W.L.; Lemons, H.A. Amsterdam, Netherlands; Elsevier Science Publishing (1983). (CONF-8211153—).

From MRS symposium on laser-solid interactions and transient thermal processing of materials; Boston, MA, USA (1 Nov 1982).

Regrowth by pulsed proton beam was studied for evaporated amorphous Si layers, for layers converted to polycrystalline by annealing (both with and without Ge markers) and for implantation-amorphized SOS films. Silicon-on-sapphire showed the lowest threshold for regrowth. Amorphous silicon melted at about 0.2 J/cm² lower fluences of protons of 380 keV energy than crystalline Si. Implanted Sb into SOS occupies lattice positions exceeding the solid solubility.

50234 Transient annealing of ion-implanted silicon using a scanning IR line source. Liu, Y.S.; Cline, H.E.; Katz, W.; Parks, H.G.; Possin, G.E. (General Electric Research and Development Center, Schenectady, New York 12345). pp 425-430 of Laser solid interactions and transient thermal processing of materials. Narayan, J.; Brown, W.L.; Lemons, H.A. Amsterdam, Netherlands; Elsevier Science Publishing (1983). (CONF-8211153—).

From MRS symposium on laser-solid interactions and transient thermal processing of materials; Boston, MA, USA (1 Nov 1982).

Recent interest in finding an efficient method for transient annealing of ion-implanted silicon has led to studies of various rapid annealing schemes such as graphite heaters and high intensity incoherent light sources as alternative methods to laser annealing. In this paper, the authors describe a recent study of transient annealing of ion-implanted silicon using a scanning IR line source created by a single tungsten filament enclosed in a quartz envelope. Various dopants (B^+, P^+ and As^+) with fluences of 10^{14} to 10^{16} ions/cm² were implanted and annealed under both transient and steady-state thermal conditions. Dopant depth distributions were analyzed using the SIMS technique. Sheet resistance measurements indicated that almost 100% activations of the implanted dopants were achieved. Sensitivities of dopant activation to transient annealing conditions were studied as a function of dopant concentrations, and high-dose As- and B-implanted samples were found to be sensitive to transient thermal cycle, particularly to the peak temperature. Recrystallization was studied with Rutherford backscattering spectroscopy using 2 Mev He^+ ions.

50235 Selective laser annealing for device processing. Calder, I.D.; Naem, A.A.; Naguib, H.H. (Bell-Northern Research, Ottawa). pp 443-448 of Laser solid interactions and transient thermal processing of materials. Narayan, J.; Brown, W.L.; Lemons, H.A. Amsterdam, Netherlands; Elsevier Science Publishing (1983). (CONF-8211153—).

From MRS symposium on laser-solid interactions and transient thermal processing of materials; Boston, MA, USA (1 Nov 1982).

Selective laser crystallization of undoped polysilicon films has been achieved through the use of a patterned Si_3N_4 anti-reflection (AR) coating. The recrystallized poly-Si beneath the AR cap exhibits an etch rate 50-90% lower than the surrounding uncapped material, allowing anisotropic etching of poly-Si for the fabrication of MOSFET gates. Undercut is reduced by at least a factor of two from unannealed material. Annealed edge profiles are uniform within + or - 0.03μm for plasma etching (+ or - 0.05 for wet etching) compared to + or - 0.1μm (+ or - 0.25μm for wet etching) for unannealed regions. The sheet resistivity of 0.5μm films doped by phosphorus diffusion was reduced from an initial value of 82+ or -5 Ω/ to 40+ or -8 Ω/ when the dopant was diffused into recrystallized poly-Si and to a final value of 10.2 + or - 0.2 Ω/ after a further laser activation step. Potential applications in VLSIC processing are discussed.

50236 Beam processing of silicon with a scanning CW Hg lamp. Stultz, T.; Gibbons, J.; Sturm, J. (Stanford Electronics Laboratory, Stanford, CA 94305). pp 463-475 of Laser solid interactions and transient thermal processing of materials. Narayan, J.; Brown, W.L.; Lemons, H.A. Amsterdam, Netherlands; Elsevier Science Publishing (1983). (CONF-8211153—).

From MRS symposium on laser-solid interactions and transient thermal processing of materials; Boston, MA, USA (1 Nov 1982).

A scanning arc lamp annealing system has been built using a 3" long mercury arc lamp with an elliptical reflector. The reflector focuses the light into a high intensity narrow line source. Silicon wafers implanted with 100 KeV $^{75}As^+$ to $1x10^{15}$ cm^{-2} have been uniformly annealed with a single scan, resulting in complete activation and negligible redistribution of the implanted species. Using a scan rate of 1cm/s, entire 3" wafers have been annealed in less than 10 seconds with this system. The system has also been used to recrystallize thin films of polysilicon deposited on thermally grown silicon dioxide. The recrystallized films contain grains that are typically 0.5-1 mm in width and several centimeters long. Surface texture measurements show the crystallites to be almost entirely (100) in the plane of the film with the orthogonal <100> direction closely paralleling the scan direction. MOSFETs were fabricated in these films with surface mobilities 66% of ones fabricated in single crystal silicon. An epitaxial layer with the same crystallographic features as the recrystallized film was grown on the film itself.

50237 Isothermal annealing of ion implanted silicon with a graphite radiation source. Wilson, S.R.; Gregory, R.B.; Hamdim, A.H.; McDaniel, F.D.; Paulson, W.M. (SRDL, Motorola, Inc., 5005 E. McDowell Road, Phoenix, Arizona). pp 369-374 of Laser solid interactions and transient thermal processing of materials. Narayan, J.; Brown, W.L.; Lemons, H.A. Amsterdam, Netherlands; Elsevier Science Publishing (1983). (CONF-8211153—).

From MRS symposium on laser-solid interactions and transient thermal processing of materials; Boston, MA, USA (1 Nov 1982).

Both (100) and (111) Si wafers were implanted with As, P or B to doses from 10^{13} to 10^{16}/cm² and annealed with a Varian IA200 isothermal annealer. The anneal occurs in a vacuum using infrared radiation for exposure times of 5 to 30 sec. Sheet resistance (R / SUB s/), Hall effect, RBS and SIMS were used to analyze the wafers. For each dopant a decreasing R /SUB s/ occurs with increasing exposure time until a minimum value is reached. Longer anneals produce increased dopant diffusion, and the R /SUB s/ for As and P implanted wafers increased unless the wafer was capped with 0.05 μm of SiO_2 which prevents a loss of dopant. The results for (100) wafers are better than for (111) with As doses $\leqq 10^{15}$/cm², however at doses $>10^{15}$/cm² the (100) and (111) results are comparable. The As implanted, isothermally annealed layers were thermally stable for As concentrations ≦2E 20/cm³.

50238 Processing of shallow (Rp<150 /SUP o/ A) implanted layers with electron beams. McMillan, G.B.; Ahmed, H.; Shannon, J.M. (Engineering Department, University of Cambridge, Cambridge CB2 1PZ). pp 437-442 of Laser solid interactions and transient thermal processing of materials. Narayan, J.; Brown, W.L.; Lemons, H.A. Amsterdam, Netherlands; Elsevier Science Publishing (1983). (CONF-8211153—).

From MRS symposium on laser-solid interactions and transient thermal processing of materials; Boston, MA, USA (1 Nov 1982).

The multiple-scan method of electron beam annealing has been used to activate shallow (Rp<150 /SUP o/ A), highly doped silicon layers produced by ion implantation of arsenic at 10keV. Beam conditions have been optimised (600Wcm^{-2} for 100ms) to produce essentially undiffused layers, as determined by high resolution SIMS, containing high concentrations of electrically active arsenic impurities. Computer modelling of diffusion effects in such layers has been used to identify optimum beam conditions and the calculations have been compared with experimental results. Hot electron device structures, which depend on negligible diffusion

and high electrical activity, have been fabricated using the multiplescan method with a peak annealing temperature of 900°C.

50239 **Surface studies of laser annealed semiconductors.** Zehner, D.M.; White, C.W. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). pp 317-328 of Laser solid interactions and transient thermal processing of materials. Narayan, J.; Brown, W.L.; Lemons, H.A. Amsterdam, Netherlands; Elsevier Science Publishing (1983). (CONF-8211153—).

From MRS symposium on laser-solid interactions and transient thermal processing of materials; Boston, MA, USA (1 Nov 1982).

The surface regions of semiconductor single crystals have been examined following laser annealing in an ultrahigh vacuum environment with the output of a pulsed ruby laser. Atomically clean surfaces with impurity levels below 0.1% of a monolayer can be produced by multiple pulse irradiation. Ordered surface structures are produced on low index oriented crystals as well as crystals slightly misoriented. Metastable surface structures exhibiting (1x1) LEED patterns have been produced on (111) orientations and are believed to be a consequence of the rapid cooling rates of 10^9 degs/sec achieved with the laser irradiation process. The surface and subsurface regions of ion-implanted Si crystals have been examined both before and after laser irradiation and results obtained from Si samples implanted with As are discussed.

50240 **Flame annealing of ion implanted silicon.** Narayan, J.; Young, R.T. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, TN 37830). pp 361-367 of Laser solid interactions and transient thermal processing of materials. Narayan, J.; Brown, W.L.; Lemons, H.A. Amsterdam, Netherlands; Elsevier Science Publishing (1983). (CONF-8211153—).

From MRS symposium on laser-solid interactions and transient thermal processing of materials; Boston, MA, USA (1 Nov 1982).

The authors have investigated flame annealing of ion implantation damage (consisting of amorphous layers and dislocation loops) in (100) and (111) silicon substrates. The temperature of a hydrogen flame was varied from 1050 to 1200°C and the interaction time from 5 to 10 seconds. Detailed TEM results showed that a "defect-free" annealing of amorphous layers by solid-phase-epitaxial growth could be achieved up to a certain concentration. However, dislocation loops in the region below the amorphous layer exhibited coarsening, i.e., the average loop size increased while the number density of loops decreased. Above a critical loop density, which was found to be a function of ion implantation variables and substrate temperature, formations of 90° dislocations (a cross-grid of dislocation in (100) and a triangular grid in (111) specimens) were observed. Electrical (Van der Pauw) measurements indicated nearly a complete electrical activation of dopants with mobility comparable to pulsed laser annealed specimens. The characteristics of p-n junction diodes showed a good diode perfection factor of 1.20-1.25 and low reverse bias currents.

50241 **Characteristics of recrystallised polysilicon on SiO_2 produced by dual electron beam processing.** Davis, J.R.; Ahmed, H.; McMahon, R.A. (Cambridge University Engineering Department, Trumpington Street, Cambridge, England, CB2 1PZ). pp 563-568 of Laser solid interactions and transient thermal processing of materials. Narayan, J.; Brown, W.L.; Lemons, H.A. Amsterdam, Netherlands; Elsevier Science Publishing (1983). (CONF-8211153—).

From MRS symposium on laser-solid interactions and transient thermal processing of materials; Boston, MA, USA (1 Nov 1982).

This paper describes the production of large areas of precisely oriented, defect-free, single crystal silicon films on SiO_2 by dual electron beam heating of deposited polysilicon using lateral epitaxy. Defects which occur in the film far from the seeding window are characterised, and the dependence of the area of the defect-free region on the processing conditions is discussed.

50242 **Electron beam processing of semiconductors.** Ahmed, H.; McMahon, R.A. (Cambridge University Engineering Department, Trumpington Street, Cambridge, England, CB2 1PZ). pp 653-664 of Laser solid interactions and transient thermal processing of materials. Narayan, J.; Brown, W.L.; Lemons, H.A. Amsterdam, Netherlands; Elsevier Science Pub. (1983). (CONF-8211153—).

From MRS symposium on laser-solid interactions and transient thermal processing of materials; Boston, MA, USA (1 Nov 1982).

Electron beams can transfer energy very efficiently to semiconductors. Systems have been developed for rapid heating to temperature around 1000°C under a variety of conditions from adiabatic to isothermal. Pulsed, focused, line and synthesized shaped beams are used to obtain a wide range of thermal cycles. The following applications are described: the annealing of ion-implanted Si, particularly the activation of As implants and shallow implants (Rp < 15oA /SUP o/), the annealing of Si and Se in GaAs, the e-beam processing of implanted silicon devices and the improvement of SOS substrate quality. Localized annealing by a computer controlled e-beam and the recrystallization of deposited films on insulators are also considered.

50243 **Explosive crystallization in a-Ge and a-Si: a review.** Bensahel, D.D.; Auvert, G. (CNET-CNS, BP.42, 38240, MEYLAN). pp 165-175 of Laser solid interactions and transient thermal processing of materials. Narayan, J.; Brown, W.L.; Lemons, H.A. Amsterdam, Netherlands; Elsevier Science Publishing (1983). (CONF-8211153—).

From MRS symposium on laser-solid interactions and transient thermal processing of materials; Boston, MA, USA (1 Nov 1982).

Self-sustained or explosive crystallization results on a-Si and a-Ge are reviewed and compared. cw laser experiments on a-Si allow to follow all the phenomena encountered, and to experimentally measure the crystallization front velocity. The published theories agree well with the experimental results on a-Si. Moreover, a-Ge presents the same behaviour as a-Si, but for a-Si, the high nucleation rate can induce a specific explosive growth.

50244 **Laser-induced solid phase crystallization in amorphous silicon films.** Olson, G.L.; Hess, L.D.; Kokorowski, S.A.; Roth, J.A. (Hughes Research Laboratories, 3011 Malibu Canyon Rd., Malibu, CA 90265). pp 141-154 of Laser solid interactions and transient thermal processing of materials. Narayan, J.; Brown, W.L.; Lemons, H.A. Amsterdam, Netherlands; Elsevier Science Publishing (1983). (CONF-8211153—).

From MRS symposium on laser-solid interactions and transient thermal processing of materials; Boston, MA, USA (1 Nov 1982).

The authors review recent work on the kinetics of laser-induced solid phase epitaxial crystallization of silicon as determined from time-resolved reflectivity measurements. Specific topics which are addressed include: the intrinsic kinetics of solid phase epitaxy (SPE) in ion-implanted and UHV-deposited films; SPE rate enhancement by implanted dopant atoms and the effects of electrical compensation on the SPE rate; and the temperature dependence of SPE and competing processes in samples containing impurity atoms at concentrations exceeding the solid solubility limit. The high temperature kinetics results are compared with predictions from transition state theory and are discussed with respect to a proposed depression in the amorphous Si melting temperature.

50245 **Charged dangling bonds and crystallization in group IV semiconductors.** Germain, P.J.; Paesler, M.A.; Sayers, D.E.; Zellama, K. (Department of Physics, North Carolina State University, Raleigh, NC 27650). pp 135-140 of Laser soil interactions and transient thermal processing of materials. Narayan, J.; Brown, W.L.; Lemons, H.A. Amsterdam, Netherlands; Elsevier Science Publishers (1983). (CONF-8211153—).

From MRS symposium on laser-solid interactions and transient thermal processing of materials; Boston, MA, USA (1 Nov 1982).

Crystallization of amorphous Ge (or Si) has been studied as a function of temperature and the flux of ionizing radiation (or doping). The crystallization growth rate v /SUB g/ takes on the form v /SUB g/ = v /SUB o/ exp(-E/kT) where v /SUB o/ is an increasing function of flux (or doping). We propose the following to explain these data: A concentration of mobile dangling bonds (DBs) exists in the bulk and near the amorphous-crystalline (a-c) interface. Ionization and doping induce transitions from the uncharged state D /SUP o/ to the charged states D^+ and D^-. The process controlling crystallization resulting in the above activation energy is discussed. Only certain sites on the a-side of the a-c interface are available for crystallization, and these sites are those which have captured DBs. The charged D^+ and D^- states have a larger capture cross section than the uncharged D /SUP o/ state. Increased concentrations of charged DBs results in an enhancement of the prefactor in the above equation.

50246 **Visualization of temperature profiles in a-Si crystallized in the explosive made by CW laser.** Rivier, M.; Cserhati, A.; Goetz, G. (Bendix Advanced Technology Center, Columbia MD 21045). pp 185-189 of Laser solid interactions and transient thermal processing of materials. Narayan, J.; Brown, W.L.; Lemons, H.A. Amsterdam, Netherlands; Elsevier Science Publishing (1983). (CONF-8211153—).

From MRS symposium on laser-solid interactions and transient thermal processing of materials; Boston, MA, USA (1 Nov 1982).

The authors present an experimental method, based on the isothermal nature of the boundaries of explosively crystallized silicon, to display instantaneous isotherms produced by fast scanning laser beams. This method is especially useful for the case of multilayer structures or complex geometries, where thermal profiles simulation is a difficult problem. We can also obtain directly a measure of the spatial intensity distribution in the laser beam.

50247 **Conduction in polycrystalline silicon: generalized thermionic emission-diffusion theory and extended state mobility model.** Khondker, A.N.; Kim, D.M.; Shah, R.R. (Electrical Engineering Department, Rice University, Houston, Texas 77251). pp 431-436 of Laser solid interactions and transient thermal processing of materials. Narayan, J.; Brown, W.L.; Lemons, H.A. Amsterdam, Netherlands; Elsevier Science Publishing (1983). (CONF-8211153—).

From MRS symposium on laser-solid interactions and transient thermal processing of materials; Boston, MA, USA (1 Nov 1982).

The authors present a general theory of conduction in polysilicon. The theoretical framework reconciles two apparently divergent approaches for modeling conduction processes in polysilicon and provides a physical basis to correctly interpret and to point out the deficiencies of previously reported thermionic and thermionic field emission theory. This model is based on an extended state mobility in the disordered grain boundary and the thermionic emission-diffusion theory for conduction of current. The attractive features of our theory are (a) it can explain the experimental data without the use of an artificial factor, f, (b) the conduction process is characterized explicitly by the inherent material properties of the grain and the grain boundary. Our model is particularly suited for describing the electrical properties of laser restructured polysilicon, where because of large grain size the diffusion process is expected to be dominant.

50248 **Temperature profiles induced by strip heaters.** Burgener, M.L.; Reedy, R.E. (Naval Ocean Systems Center, San Diego, California, 92152). pp 613-618 of Laser solid interactions and transient thermal processing of materials. Narayan, J.; Brown, W.L.; Lemons, H.A. Amsterdam, Netherlands; Elsevier Science Pub. (1983). (CONF-8211153—).

From MRS symposium on laser-solid interactions and transient thermal processing of materials; Boston, MA, USA (1 Nov 1982).

The authors present a model based on analytic solutions to the heat equation that calculates the temperature profiles induced by line shaped heat sources. The sensitivity of isotherms to various heating conditions including the effect of tailoring power profiles in both curved and straight sources is discussed. Conditions are presented that result in "dogboned" shaped isotherms. Also shown is the effect that inhomogeneities (e.g., power density fluctuations or defects in the material) have on the ideal temperature profiles.

50249 **Analysis of temperature and stress profiles induced by a CW line scanned electron beam in <100> oriented silicon.** Bentini, G.G.; Correra, L. (C.N.R. - ISTITUTO LAMEL, Via Castagnoli 1, 40126 Bologna). pp 241-246 of Laser solid interactions and transient thermal processing of materials. Narayan, J.; Brown, W.L.; Lemons, H.A. Amsterdam, Netherlands; Elsevier Science Publishing (1983). (CONF-8211153—).

From MRS symposium on laser-solid interactions and transient thermal processing of materials; Boston, MA, USA (1 Nov 1982).

Evaluation of thermal profiles along the scan direction of a line shaped e-beam as well as the topographic distribution of the thermally induced stresses have been performed by solving the heat diffusion equation for several incident power values. The resulting stresses have been computed in the "nearly isotropic" approximation but taking into account that the slip planes, in <100> oriented silicon crystals, are (111) and the slip directions in the plane are <110>. The threshold of damage introduction has been evaluated by comparing the computed stresses with the yield stress of the material at any annealing temperature. Experimental observations based on X-Ray topography have been performed in order to study the damage introduction on <100> silicon samples annealed in the same conditions used for stress computation. A very good agreement between computed and experimental results was found.

50250 **Impurity diffusion in silicon annealed by semi-continuous laser.** Bouree, J.E.; Leray, C.; Rodot, M. (CNRS, 1 Place A. Briand, 92190 - Meudon). pp 221-227 of Laser solid interactions and transient thermal processing of materials. Narayan, J.; Brown, W.L.; Lemons, H.A. Amsterdam, Netherlands; Elsevier Science Publishing (1983). (CONF-8211153—).

From MRS symposium on laser-solid interactions and transient thermal processing of materials; Boston, MA, USA (1 Nov 1982).

The diffusion of an impurity into a solid which is irradiated by laser pulses of some milliseconds duration has been analysed in terms of effective diffusion time and temperature. In the case of Fe in Si, the diffusion coefficient is found to be similar to that measured by COLLINS and CARLSON, and independent of boron doping. In the case of Al in Si, a value of 2.10^{-10} cm²/s at 1400°C has been found both for single crystals and for fine-grained polycrystals.

50251 **Interferometric measurements of surface properties during laser annealing.** Bertolotti, M.; Ferrari, A.; Jani, P.; Siblia, C. (Istituto di Fisica, Ingegneria, Universita Roma). pp 217-220 of Laser solid interactions and transient thermal processing of materials. Narayan, J.; Brown, W.L.; Lemons, H.A. Amsterdam, Netherlands; Elsevier Science Publishing (1983). (CONF-8211153—).

From MRS symposium on laser-solid interactions and transient thermal processing of materials; Boston, MA, USA (1 Nov 1982).

A simple interferometric method is presented which allows measurement of small vertical displacement of a surface heated by a laser beam. Calculations applied to a silicon crystal in the case of a c.w. laser show reasonable agreement with experiment. The method can be applied to assess surface temperature and thermal constants.

50252 **Laser-induced surface defects.** Moison, J.M.; Bensoussan, M. (Centre National d'Etudes des Telecommunications, Departement OMT, 196 rue de Paris 92220 BAGNEUX). pp 329-334 of Laser solid interactions and transient thermal processing of materials. Narayan, J.; Brown, W.L.; Lemons, H.A. Amsterdam, Netherlands; Elsevier Science Publishing (1983). (CONF-8211153—).

From MRS symposium on laser-solid interactions and transient thermal processing of materials; Boston, MA, USA (1 Nov 1982).

The influence of pulsed laser processing (PLP) on the structure and composition of Si, GaAs, InP and Au surfaces has been investigated as a function of the laser fluence. Above a threshold fluence, all initial structures turn into a (1x1) structure and the V-element content of the compound surfaces is decreased. The structure change is shown to be related to the existence of a number of atomic steps on the PLP surface (up to $10^{14}/cm^2$ equivalent broken bonds). These defects can be eliminated by further annealings. On the other hand, the stoechiometry defects, which are less numerous (10^{12}-$10^{13}/cm^2$) cannot be eliminated. A model for the mechanisms of defect creation and annihilation during PLP is outlined. The incidence of PLP-induced defects on device technology is evaluated.

50253 **Picosecond laser-induced surface transformations in solids.** Fauchet, P.M.; Guosheng, Z.; Siegman, A.E. (Edward L. Ginzton Laboratory, Stanford University, Stanford, CA 94305). pp 205-210 of Laser solid interactions and transient thermal processing of materials. Narayan, J.; Brown, W.L.; Lemons, H.A. Amsterdam, Netherlands; Elsevier Science Publishing (1983). (CONF-8211153—).

From MRS symposium on laser-solid interactions and transient thermal processing of materials; Boston, MA, USA (1 Nov 1982).

The authors report the results of a study of surface transformations in semiconductors (Si, GaAs) and metals (Cu) produced by 100 ps long pulses from a Nd:YAG laser system. They also present and outline the conclusions of our model for growth of spontaneous periodic surface structures or ripples often associated with laser damage and annealing. The effect of repetitive subthreshold illumination is also examined. Theoretical analysis is presented to support time-resolved experiments performed with two excitation pulses at different wavelengths.

50254 **Movement of edge dislocations in KCl by large electric fields.** Colombo, L.; Kataoka, T.; Li, J.C. (Univ. of Rochester, NY). *Philosophical Magazine, [Part] A: Defects and Mechanical Properties;* **46**: No. 2, 211-215(1982). Contract AC02-76ER02296.

Bands of etch pits resembling slip bands have been produced from an identation made on the (001) surface of a KCl crystal containing nominally 88 ppm Ca^{2+} by the sole action of a dc field up to 15 MV m^{-1} along [100]. Only edge dislocation bands appeared, extending from the indentation towards the anode and forming an asymmetric rosette pattern. From the minimum field needed to produce such edge bands and the yield stress of the crystal, a charge of -7 X 10^{-11} C m^{-1} was obtained for the edge dislocations.

50255 **Internal stresses.** Li, J.C.M. (Univ. of Rochester, NY). pp 227-240 of Plastic deformation of amorphous and semicrystalline materials. Escaig, B.; G'Sell, C. (eds.). Les Ulis, France; Les Editions de Physique (1982). Contract AC02-76ER02296.

Some sources of internal stresses and their estimation are illustrated. Stress relaxation is presented as a simple method of determining the level of internal stress. A model of internal stress distribution in an amorphous structure is presented. In crystalline substances, a major source of internal stress is due to dislocations. Some simple dislocation arrangements are presented together with a method of calculating their stress fields. Topics of discussion include: shear bands and finite walls; infinite walls and boundaries; and pileups and cracks. The two major causes of internal stresses due to chemical effects are discussed. The first is diffusion induced stresses and the second is precipitation or transformation-induced stresses. Glass and amorphous structures are discussed in relation to a distribution of internal stresses.

40 CHEMISTRY

50256 **(DOE/ER—0144/2) Summaries of FY 1984 research in the chemical sciences.** (USDOE Office of Energy Research, Washington, DC. Chemical Sciences Div.). Sep 1984. 124p. NTIS, PC A06/MF A01; GPO Dep. File Number DE84016032.

The purpose of this publication is to inform those interested in research supported by the Department of Energy's Division of Chemical Sciences, which is one of six Divisions of the Office of Basic Energy Sciences in the Office of Energy Research. This year, for the first time, this publication shows projects supported by that portion of the Nuclear Sciences budget which is administered by the Division of Chemical Sciences. Areas of research supported by the Division are seen in the section headings, the index and the summaries themselves. About half the projects take place at DOE laboratories, and half take place at universities and industrial laboratories.

50257 **(OEFZS—4273) Department of Chemistry of the Austrian Research Centre Seibersdorf.** Proksch, E. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). Mar 1984. 10p. (In German). (CH—329/84). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703182.

The present report describes the R and D work carried out during 1981 to 1983. This work is still almost exclusively devoted to applied research items; a major fraction of the capacity available is devoted to contract research. The main R and D areas are: - applied radiation chemistry - conditioning of wastes - nuclear fuel chemistry and technology - non-nuclear technical chemistry - radioisotopes and labelled compounds - analytical chemistry.

4001 Analytical And Separations Chemistry

REFER ALSO TO CITATION(S) 40010049508, 49568, 50100, 50158, 50413, 50747

50258 **(CONF-841023—Absts.) Twenty-seventh ORNL/DOE conference on analytical chemistry in energy technology: abstracts.** (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 46p. NTIS, PC A03/MF A01; GPO Dep. File Number DE84017316.

From 27. ORNL-DOE conference on analytical chemistry in energy technology; Knoxville, TN, USA (2 Oct 1984).

Abstracts are presented of 45 papers on chemical analysis in the environmental, nuclear, and energy fields. (DLC)

50259 **(CONF-8311198—1) Separation of lithium ions by chromatography.** Lee, D.A. (Oak Ridge National Lab., TN (USA)). 12 Nov 1983. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000972.

From Southeastern Regional American Chemical Society meeting; Charlotte, NC, USA (9 Nov 1983).

Trioctylphosphine oxide (TOPO) forms an adduct with lithium dibenzoylmethane (DBM). The chelate is readily extractable by nonaqueous solvents, and this is the basis for the chromatographic separation of lithium from other alkali ions. A liquid chromatography column with 0.1 M DBM - 0.1 M TOPO in dodecane as the stationary phase was used. Lithium ions were retrained on the column while the remaining alkali metal ions were eluted with ammonium hydroxide. Lithium was eluted with 0.6 N hydrochloric acid. The structure of the extracted lithium species was determined by extraction equilibria studies and by the method of continuous variations.

50260 **(CONF-8403148—1) X-ray microprobe characterization of materials: the case for undulators on advanced storage rings.** Sparks, C.J. Jr. (Oak Ridge National Lab., TN (USA)). 17 Mar 1984. Contract AC05-84OR21400. 35p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85001096.

From Major Materials Facilities Committee of the National Research Council seminar; Washington, DC, USA (17 Mar 1984).

The unique properties of X rays offer many advantages over electrons and other charged particles for the microcharacterization of materials. X rays are more efficient in exciting characteristic X-ray fluorescence and produce higher fluorescent signals to backgrounds than obtained with electrons. Detectable limits for X rays are a few parts per billion and are 10^{-3} to 10^{-5} less than for electrons. Energy deposition in the sample by X rays is 10^{-3} to 10^{-4} less than for electrons for the same detectable concentration. High-brightness storage rings, especially in the 6 GeV class with undulators, will be approximately 10^3 brighter in the X-ray energy range from 5 keV to 35 keV than existing storage rings and provide for

X-ray microprobes that are as bright as the most advanced electron probes. Such X-ray microprobes will produce unprecedented low levels of detection in diffraction, EXAFS, Auger, and photoelectron spectroscopies for both chemical characterization and elemental identification. These major improvements in microcharacterization capabilities will have wide-ranging ramifications not only in materials science but also in physics, chemistry, geochemistry, biology, and medicine.

50261 **(CONF-8405242—1) Matrix scientist in a matrix organization.** Shults, W.D.; Roseberry, L.M. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001894.

From ACS regional meeting; Kalamazoo, MI, USA (23 May 1984).

We believe that the current training in analytical chemistry is quite good considering the multitude of objectives and limitations involved. Eventually we will have to come to grips with the question, Do we want a liberal sciences degree that extends over four years and encompasses essentially diverse training in the sciences at the expense of nonscience courses, or do we want to move to a five year program wherein the undergraduate student gets both liberal arts and liberal sciences training. Our experience suggests that PhD-level students benefit markedly from formal training. We would suggest that seminars at all levels be used to acquaint students with the basics and language of other scientific disciplines so that they, as professionals, will be better prepared to communicate with people in the other disciplines. We suggest that curricula retain the laboratory experience and emphasize chemistry by objective. Students mature when they are part of a project with an objective that he or she can relate to. They learn to see the whole problem and to choose the optimum way to approach it. This fosters professionalism. That's the bottom line. We all want curricula that produces well-rounded, competent professionals in analytical chemistry.

50262 **(DOE/ER/10946—1) Mechanisms of cake filtration. Progress report.** (Houston Univ., TX (USA). Dept. of Chemical Engineering; Martin Marietta Labs., Baltimore, MD (USA)). 30 Apr 1982. Contract AS05-81ER10946. 60p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85000301.

Solid-liquid separation (SLS) techniques are important in many fields. SLS may be divided into four areas: pretreatment to increase particle size, thickening of slurry, filtration or centrifugation, and post-treatment by washing or deliquoring. This paper is an attempt to relate the microscopic properties of particles to the macroscopic properties of slurries, cake, and supporting media. Both theory and experiment were utilized. (DLC)

50263 **(DOE/ER/10946—2) Mechanisms of cake filtration. Second progress report, May 1982-April 1983.** (Houston Univ., TX (USA). Dept. of Chemical Engineering; Martin Marietta Labs., Baltimore, MD (USA)). 15 May 1983. Contract AS05-81ER10946. 28p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85000350.

Progress is reported in the following areas: cake structure and compressibility, theory of flow through compressible cakes, null state porosity, capillary suction apparatus, thickening and sedimentation, centrifugal filtration, and gravity filtration with falling head. (DLC)

50264 **(DOE/ER/10946—3-Pt.1) Mechanisms of cake filtration. Third progress report, Part I, September 1981-April 1984.** (Houston Univ., TX (USA). Dept. of Chemical Engineering). 15 Jun 1984. Contract AS05-81ER10946. 162p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE85001107.

This project has been aimed at further development of the theory of separation of solids from liquids in operations involving compressible particulate beds or sediments as found in filtration, centrifugation, and sedimentation. Generation of reliable data under well-defined conditions and integrating the areas of pre-treatment, thickening, and separation are objectives of the research. Particle characteristics are being related to suspension behavior and cake structure. Sedimentation rates and cake structure are being correlated. The initial structure of deposits as affected by surface charge, suspension concentration, and agitation is being studied in relation to resistance to flow. Included in the program are internal flow mechanisms involving porosity and pressure distribution. Fine particle migration is being related to cake and medium blinding. An attempt is being made to relate the microscopic particle characteristics to the macroscopic behavior of cakes and sediments.

50265 **(DOE/ER/10946—3-Pt.2) Mechanisms of cake filtration. Third progress report, Part II, September 1981-April 1984.** (Martin Marietta Labs., Baltimore, MD (USA)). 15 Jun 1984. Contract AS05-81ER10946. 59p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85000937.

Emphasis was placed on exploring correlations between slurry properties and filtration behavior. Filtration of polystyrene latex (model) dispersions was studied. (DLC)

50266 **(GKSS—84/E/6) Development of an analytical procedure for the determination of traces of dissolved heavy metals in seawater by means of total reflection X-ray fluorescence analysis.** Prange, A. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.). Abt. Strahlenschutz; Hamburg Univ. (Germany, F.R.). Fachbereich Chemie). 1984. 260p. (In German). NTIS (US Sales Only), PC A12/MF A01. File Number DE84752170.

Based on the total reflection-X-ray fluorescence analysis (TXRF) a trace analytically assessed procedure is presented, which allows a multi-element determination of dissolved heavy metals in sea-water down to the ng/kg concentration region by combination of TXRF with simple sample preparation steps. The necessary separation of the element traces from the salt matrix was accomplished through complexation with sodiumdibenzyldithiocarbamate and subsequent reverse-phase-chromatography. The procedure was investigated with regard to sources of systematic errors. Results obtained in the course of two research trips to the Baltic Sea and to the Middle Pacific are described and discussed.

50267 **(INIS-mf—9035) Microelements '80. Conference proceedings.** Benes, S.; Kalous, F. (eds.). (Ministerstvo Zemedelstvi a Vyzivy, Prague (Czechoslovakia). Statni Veterinarni Sprava). 1981. 29p. (In Czech and Slovak). (CONF-8005254—). NTIS (US Sales Only), PC A03/MF A01. File Number DE84780552.

From Microelements '80 meeting; Horni Becva, Czechoslovakia (5 May 1980).

The proceedings contain 24 papers of which 4 were processed for INIS. The subject of the said four papers was the use of neutron activation analysis for determining elements in biological materials.

50268 (INIS-mf—9035, pp 14-20) **Trace element determination in biological materials by neutron activation analysis.** Obrusnik, I. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). 1981. (In Czech). NTIS (US Sales Only), PC A03/MF A01. File Number TI84780552. (CONF-8005254—).

From Microelements '80 meeting; Horni Becva, Czechoslovakia (5 May 1980).

A survey is presented of elements which may be determined using the method of instrumental neutron activation analysis (INAA) at short-term irradiation in a reactor (0.5-5 mins), at long-term irradiation (2-100 hrs) and with the activation of samples with epithermal neutrons during long-term irradiation. The elements whose instrumental determination is hindered by an increased background and matrix interferences may be determined using neutron activation analysis with radiochemical separation (RNAA). Separation is carried out by extraction, ion exchange chromatography, distillation, etc. A theoretical comparison of INAA and RNAA of biological materials is made according to the number of determinable elements and accuracy of determination is given in %.

50269 (INIS-mf—9035, pp 28-34) **Problems of chromium determination in biological materials.** Duchacek, V.; Jiranek, V.; Bludovsky, R. (Vyzkumny Ustav Potravinarskeho Prumyslu, Prague (Czechoslovakia)). 1981. (In Czech). NTIS (US Sales Only), PC A03/MF A01. File Number TI84780552. (CONF-8005254—).

From Microelements '80 meeting; Horni Becva, Czechoslovakia (5 May 1980).

The following problems arise in the determination of chromium in biological materials: contamination by instruments and chemical utensils used, chromium losses during drying and mineralization and the effect of the applied analytical technique. The use of neutron activation analysis for the determination of chromium solves the greater part of the former two problems. Recommended instruments and chemical utensils are discussed. The circumstances are summed up leading to losses caused by drying and mineralization, the effect of the interference of gamma spectrum measurement and the overlapping of the ^{51}Cr photopeak by beta radiation and the Compton background.

50270 (INIS-mf—9052, pp 37) **Energy dispersive X-ray elemental analysis for pigments identification of tempera painting.** Karamanova, Zh.; Nacheva-Khristova, V.; Nikolova, E. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). 1983. (In Bulgarian). NTIS (US Sales Only), PC A99/MF A01. File Number TI84780548. (CONF-8309253—Absts.).

From 1. national congress of the physicists in Bulgaria; Sofia, Bulgaria (28 Sep 1983).

50271 (INIS-mf—9065, pp 8-13) **Scanning proton microprobe and its place in elemental microanalysis.** Legge, G.J.F. (Melbourne Univ., Parkville (Australia). School of Physics). Nov 1983. NTIS (US Sales Only), PC A10/MF A01. File Number TI84780622. (CONF-8311183—).

From 3. Australian conference on nuclear techniques of analysis; Lucas Heights, Australia (1 Nov 1983).

The characteristics of proton microprobes are summarized and areas of application are indicated. Sensitivity, spatial resolution, imaging techniques and data handling are considered.

50272 (INIS-mf—9065, pp 14-15) **Neutron activation analysis on a series of human gallstones.** Kennard, C.H.L. (Queensland Univ., St. Lucia (Australia). Dept. of Chemistry). Nov 1983. NTIS (US Sales Only), PC A10/MF A01. File Number TI84780622. (CONF-8311183—).

From 3. Australian conference on nuclear techniques of analysis; Lucas Heights, Australia (1 Nov 1983).

A pilot study was undertaken on gallstones from eight patients. Neutron activation analysis indicated the presence of iodine, chlorine, sodium, manganese, bromine, copper, cobalt and gold.

50273 (INIS-mf—9065, pp 19-21) **Use of computers in neutron activation analysis.** Fardy, J.J.; Bowles, C.J.; Porritt, R.E.J. (Commonwealth Scientific and Industrial Research Organization, Lucas Heights (Australia). Div. of Energy Chemistry). Nov 1983. NTIS (US Sales Only), PC A10/MF A01. File Number TI84780622. (CONF-8311183—).

From 3. Australian conference on nuclear techniques of analysis; Lucas Heights, Australia (1 Nov 1983).

Programs used at Lucas Heights Research Laboratories to process data produced by neutron activation analysis are briefly outlined.

50274 (INIS-mf—9065, pp 27-28) **Charge monitoring in an external proton beam.** Wookey, C.W.; Rouse, J.L. (Melbourne Univ., Parkville (Australia). School of Physics). Nov 1983. NTIS (US Sales Only), PC A10/MF A01. File Number TI84780622. (CONF-8311183—).

From 3. Australian conference on nuclear techniques of analysis; Lucas Heights, Australia (1 Nov 1983).

A number of problems are minimized for elemental analysis of material if the target is kept outside the vacuum. One problem with external analysis is the difficulty of accurately measuring the charge incident on the target. Four methods of monitoring charge were investigated. It was found that the charge collected from the target and exit foil and the gamma-ray counts and backscattered proton counts from the exit foil were proportional to the charge incident on the target, and were stable to changes in current and in time.

50275 (INIS-mf—9065, pp 35-37) **Target damage in MeV ion beam microanalysis of biological tissue.** Sealock, R.M.; Kirby, B.J.; Mazzolini, A.P.; Legge, G.J.F. (Melbourne Univ., Parkville (Australia). School of Physics). Nov 1983. NTIS (US Sales Only), PC A10/MF A01. File Number TI84780622. (CONF-8311183—).

From 3. Australian conference on nuclear techniques of analysis; Lucas Heights, Australia (1 Nov 1983).

Target damage induced by 3 MeV proton and 2 MeV α-particle bombardment of thin sections of freeze dried biological tissue has been studied. Yields of ions scattered from H and C, characteristic X-rays, and bremsstrahlung continuum x-rays were measured versus accumulated charge on the target for current densities in the range 10^{-10} to 10^{-15} A/μm^2. Structural damage, discolouration and loss of mass and of major constituent elements have been observed. Implications of these studies for ion beam microanalysis of tissue are discussed and beam current density limits are recommended.

50276 (INIS-mf—9065, pp 38-40) **Application of an alpha particle microbeam to tissue analysis in medicine.** Mazzolini, A.P.; Sealock, R.M.; Legge, G.J.F. (Melbourne Univ., Parkville (Australia). School of Physics). Nov 1983. NTIS (US Sales Only), PC A10/MF A01. File Number TI84780622. (CONF-8311183—).

From 3. Australian conference on nuclear techniques of analysis; Lucas Heights, Australia (1 Nov 1983).

An alpha particle microbeam with spatial resolution of 1 μ has been used to measure the distribution of Na and other light elements in mammalian tissue. The problems of tissue preparation and irradiation damage, together with the advantages of using an alpha particle microbeam instead of the more conventional electron microprobe, are discussed.

50277 (INIS-mf—9065, pp 41-43) **Elemental microanalysis of individual blood cells.** O'Brien, P.M.; Cerini, J.; Legge, G.J.F. (Melbourne Univ., Parkville (Australia). School of Physics). Nov 1983. NTIS (US Sales Only), PC A10/MF A01. File Number TI84780622. (CONF-8311183—).

From 3. Australian conference on nuclear techniques of analysis; Lucas Heights, Australia (1 Nov 1983).

Results from a proton microprobe study of normal human erythrocytes have shown that the x-ray spectrum of a single cell is reproduceable and that a nuclear microprobe has the sensitivity and resolution to observe elemental localization on a subcellular level. Elements observed were P,S,Cl,K,Fe and traces of Zn.

50278 (INIS-mf—9065, pp 44-49) **Current techniques in neutron activation analysis.** Fardy, J.J. (Commonwealth Scientific and Industrial Research Organization, Lucas Heights (Australia). Div. of Energy Chemistry). Nov 1983. NTIS (US Sales Only), PC A10/MF A01. File Number TI84780622. (CONF-8311183—).

From 3. Australian conference on nuclear techniques of analysis; Lucas Heights, Australia (1 Nov 1983).

Recent trends in neutron activation techniques are reviewed from literature published since 1980. A significant advance has been the recent availability of the NAA Advance Prediction Computer Program from the University of California which provides an excellent guide for the optimisation of NAA procedures. Many laboratories have introduced techniques to increase both the number and sensitivity of elements detected, using high-intensity reactor pulses, cyclic NAA, epithermal irradiations, and anticoincidence-shielded Ge(Li) and low-energy photon detectors. The basic comparator procedure for NAA has been augmented by the use of absolute, single comparator and k_0-standardisation methods. Finally, the increased scale of automation of NAA from 5000 samples per year facility at the Interuniversity Reactor Institute of Delft to 400 samples per day at the Los Alamos National Laboratory facility, is described.

50279 (INIS-mf—9065, pp 50-52) **Microscopic determination of ^{10}B for boron neutron capture therapy of malignant melanoma.** Wilson, D.J.; Linklater, H.; Izard, B.E.; Allen, B.J. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Nov 1983. NTIS (US Sales Only), PC A10/MF A01. File Number TI84780622. (CONF-8311183—).

From 3. Australian conference on nuclear techniques of analysis; Lucas Heights, Australia (1 Nov 1983).

The uptake of ^{10}B compounds by malignant melanoma is a key factor in the development of boron neutron capture therapy. Tumour/tissue ^{10}B concentrations are required in order to calculate the RBE dose delivered to the tumour and healthy tissues. Microscopic distributions of boron within a tumour section are also of histological interest. These biodistributions can be determined by thermal neutron irradiation of frozen tumour sections between CR-39 slides, and counting alpha particle tracks after etching the slides. The sensitivity and spatial resolution of the method are described.

50280 (INIS-mf—9065, pp 56-58) **Measurement of lean body mass in animals by thermal neutron capture gamma-ray analysis.** Thomas, B.J. (Queensland Inst. of Tech., Brisbane (Australia)); Ternouth, J.H.; Cleary, J.; Charles, D.D. (Queensland Univ., St. Lucia (Australia)). Nov 1983. NTIS (US Sales Only), PC A10/MF A01. File Number TI84780622. (CONF-8311183—).

From 3. Australian conference on nuclear techniques of analysis; Lucas Heights, Australia (1 Nov 1983).

Body nitrogen is proportional to body protein content and therefore a close relationship exists between fat free mass and total body nitrogen. A rapid determination of TBN can be accomplished using thermal neutron capture gamma-ray analysis. A facility designed for measurement of TBN in sheep is described and a preliminary assessment of the facility is presented.

50281 (INIS-mf—9065, pp 59-62) **Nuclear reaction analysis profiling.** Bird, J.R. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Nov 1983. NTIS (US Sales Only), PC A10/MF A01. File Number TI84780622. (CONF-8311183—).

From 3. Australian conference on nuclear techniques of analysis; Lucas Heights, Australia (1 Nov 1983).

Nuclear reactions can be applied for the determination of a wide range of nuclides. The most successful applications, as well as the data available and methods used for absolute calculations of isotope concentrations for use in both assay and profiling are assessed.

50282 (INIS-mf—9065, pp 65-67) **Helium microprobe analysis at Melbourne of semiconductor materials.** McKenzie, C.D. (Melbourne Univ., Parkville (Australia). School of Physics). Nov 1983. NTIS (US Sales Only), PC A10/MF A01. File Number TI84780622. (CONF-8311183—).

From 3. Australian conference on nuclear techniques of analysis; Lucas Heights, Australia (1 Nov 1983).

The possibilities and problems in the use of a helium microprobe in the analysis of semiconductor materials are discussed. The technique of channeling contrast microscopy is described.

50283 (INIS-mf—9065, pp 68-70) **Channeling contrast microscopy: application to large grain polycrystalline silicon.** McCallum, J.C.; McKenzie, C.D. (Melbourne Univ., Parkville (Australia). School of Physics); Williams, J.S. (Royal Melbourne Inst. of Tech. (Australia)). Nov 1983. NTIS (US Sales Only), PC A10/MF A01. File Number TI84780622. (CONF-8311183—).

From 3. Australian conference on nuclear techniques of analysis; Lucas Heights, Australia (1 Nov 1983).

A scanning $^{4}He^{+}$ microbeam, together with the technique of channeling contrast microscopy, has been used to image individual grains of an Sb implanted, furnace annealed, large grain polycrystalline silicon sample and to obtain the corresponding Sb profiles.

50284 (INIS-mf—9065, pp 71-73) **Thermal migration of tin into gallium arsenide.** Brown, R.A. (Melbourne Univ., Parkville (Australia). School of Physics); Johnson, S.T.; Williams, J.S. (Royal Melbourne Inst. of Tech. (Australia)); Mitchell, I.V. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Nov 1983. NTIS (US Sales Only), PC A10/MF A01. File Number TI84780622. (CONF-8311183—).

From 3. Australian conference on nuclear techniques of analysis; Lucas Heights, Australia (1 Nov 1983).

The usefulness of analysis techniques including Rutherford backscattering, channeling using both macro- and micro-beams of MeV He^{++} ions, particle-induced x-ray emission, SEM and x-ray fluorescence in characterising a Sn/GaAs system which displays local surface and compositional irregularities is demonstrated.

50285 (INIS-mf—9065, pp 80-85) **Archaeometry.** Duerden, P. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Nov 1983. NTIS (US Sales Only), PC A10/MF A01. File Number TI84780622. (CONF-8311183—).

From 3. Australian conference on nuclear techniques of analysis; Lucas Heights, Australia (1 Nov 1983).

The application of ion beam techniques to the analysis of archaeological materials is reviewed. Techniques discussed include PIXE, Rutherford backscattering, forward recoil scattering and prompt nuclear analysis.

50286 (INIS-mf—9065, pp 86-88) **Studies of obsidian and glass via the nuclear microprobe and sodium depth profiles.** Coote, G. (Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Inst. of Nuclear Sciences). Nov 1983. NTIS (US Sales Only), PC A10/MF A01. File Number TI84780622. (CONF-8311183—).

From 3. Australian conference on nuclear techniques of analysis; Lucas Heights, Australia (1 Nov 1983).

The 1012 and 1164 KeV resonances in the $^{23}Na(p,\alpha\gamma)^{20}Ne$ reaction have been used to measure the depth profile of sodium in hydrated surfaces of obsidian, pyrex and soft glass. In obsidian and hard glass, sodium was found to diffuse towards a focused beam.

50287 (INIS-mf—9065, pp 89-95) **Selected topics in surface analysis by high-energy ion beams.** Butler, J.W. (Naval Research Lab., Washington, DC (USA)). Nov 1983. NTIS (US Sales Only), PC A10/MF A01. File Number TI84780622. (CONF-8311183—).

From 3. Australian conference on nuclear techniques of analysis; Lucas Heights, Australia (1 Nov 1983).

Recent developments in selected areas of analysis of surface layers by means of high-energy ion beams are reviewed. The complementary use of a variety of methods is illustrated in an investigation of the nature of the surface of a bearing-steel sample implanted with titanium ions. Some refinements to the nuclear resonance profile method are described. These include modification of the calculation algorithm for the yield from a narrow resonance to include the Vavilov theory for fluctuations in energy loss; a matrix approach to the calculation of the depth concentration profile; and a more efficient method of numeric integration.

50288 (INIS-mf—9065) **Third Australian conference on nuclear techniques of analysis.** (Australian Inst. of Nuclear Science and Engineering, Lucas Heights). Nov 1983. 204p. (CONF-8311183—). NTIS (US Sales Only), PC A10/MF A01. File Number DE84780622.

From 3. Australian conference on nuclear techniques of analysis; Lucas Heights, Australia (1 Nov 1983).

Abstracts of individual items from the conference were prepared separately for the data base.

50289 **(Juel—1891) Investigations of the double plasma arc in a graphite tube.** Arens, C.; Mazurkiewicz, M.; Nickel, H. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorwerkstoffe und Heisse Zellen; Technische Hochschule Aachen (Germany, F.R.)). Jan 1984. 109p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE84752112.

In atomic emission spectroscopy, the double plasma arc in a graphite tube presents an advanced arc source for analysis of powders and solutions. The sample to be analysed is evaporated and excited by two 10 A dc-arcs, a graphite tube surrounding the arc arrangement. Under this influence of the graphite tube the particle residence time in the plasma is substantially increased. This report presents some investigations of the operative mechanism of the graphite tube and of the influence of various discharge atmospheres on line intensities. The aim of these investigations was to optimize evaporation and excitation conditions for the analysis of graphitic reactor materials. During the arc discharge, sample material is deposited on the inner tube wall. The tube has reflector-like properties and the material is re-transferred from the tube into the plasma where it is once more excited. Although elements with favourable thermochemical properties can re-evaporate from the hot tube wall (1870 K) into the plasma, the material re-transfer is principally caused by the corrosion of the graphite tube, which affects all elements alike. An argon/oxygen mixture (Ar/O_2 1:1, flow rate 600 ml/min) was found to be the optimal discharge atmosphere. The exposure time for the registration of spectra was 20 s in air and 30 s in other discharge atmospheres. The plasma region immediately adjacent to the anode was best suited for analytical evaluation.

50290 **(LA—10013-MS) High-precision isotopic analysis of nanogram quantities of plutonium.** Perrin, R.E.; Knobeloch, G.W.; Armijo, V.M.; Efurd, D.W. (Los Alamos National Lab., NM (USA)). Jun 1984. Contract W-7405-ENG-36. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001525.

A surface ionization-diffusion-type ionization source that uses a rhenium filament overplated with platinum has been developed and optimized for 0.5- to 2-ng plutonium samples. This source is capable of measuring the $^{240}Pu/^{239}Pu$ atom ratio in nuclear-test-debris samples to 0.15% precision and accuracy at the 95% confidence level.

50291 **(OEFZS—4050) On-stream determination of Zn-content in Zn-ore slurries by radioisotope excited X-ray fluorescence.** Donhoffer, D.; Muehldorf, V.; Stehno, G. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). Dec 1980. 38p. (IA—98/80). NTIS (US Sales Only), PC A03/MF A01. File Number DE84703162.

The development of an isotope excited X-ray fluorescence measuring system is described. A prototype unit has been tested on-stream. Results for single-element measurement and for simultaneous measurement of the elements Ca, Fe, Zn and Pb are given. The concept of a modular measuring system on the basis of microprocessors for on-stream applications is given.

50292 **Method of preparing $(CH_3)_3SiNSO$ and byproducts thereof.** Spicer, L.D.; Bennett, D.W.; Davis, J.F. (to Dept. of Energy). US Patent 4,459,421. 10 Jul 1984. Filed date 10 Aug 1982. vp.

PAT-APPL-406801.

$(CH_3)_3SiNSO$ is produced by the reaction of $((CH_3)_3Si)_2NH$ with SO_3. Also produced in the reaction are $((CH_3)_3Si)_2O$ and a new solid compound $(NH_4)((CH_3)_3SiOSO_3)$. Both $(CH_3)_3SiNSO$ and $(NH_4)((CH_3)_3SiOSO_3)$ have fluorescent properties. The reaction of the subject invention is used in a method of measuring the concentration of SO_2 pollutants in gases. By the method, a sample of gas is bubbled through a solution of $((CH_3)_3Si)_2NH$, whereby any SO_2 present in the gas will react to produce the two fluorescent products. The measured fluorescence of these products can then be used to calculate the concentration of SO_2 in the original gas sample. The solid product $(NH_4)((CH_3)_3SiOSO_3)$ may be used as a standard in solid state NMR spectroscopy.

50293 **Separation factor method for the analysis of ideal binary mixtures in gas-solid adsorption.** Lee, T.V.; Huang, J.C.; Madey, R. (Kent State Univ., OH). *Separation Science and Technology;* **19**: No. 2-3, 157-172(1984).

A correlation formula based on the separation factor is proposed for the mixture concentration in the adsorbed phase of an ideal binary solution in gas-solid adsorption. This formula is shown to apply to two binary systems (viz., 1,3-butadiene and n-butane on cross-linked polystyrene at 25°C, and acetylene and ethane on activated carbon at 25°C) with similar molecular and thermodynamic properties in the two components for each system. Comparison between the calculated and experimental values of the separation factor showed that the assumption of an ideal mixture is justified for each of these two binary systems. Mixture isotherms for the two ideal binary systems are calculated by the proposed correlation formula from the corresponding single-component isotherms. Good agreement between the calculated and experimental mixture isotherm data confirms that a binary system of two components with similar molecular properties (viz., molecular weight, normal boiling point, vapor pressure, number of carbon atoms in molecules, etc.) tends to form an ideal mixture (i.e., one with a constant separation factor.). 24 references, 5 tables.

50294 **Selection of the best elemental variables for the classification of glass samples.** Hickman, D.A.; Harbottle, G.; Sayre, E.V. (Metropolitan Police Forensic Science Lab., London, England). *Forensic Science International;* **23**: 189-212(1983).

Neutron activation analysis, inductively coupled plasma-atomic emission spectrometry, flame atomic emission spectrometry and atomic absorption spectrometry have been employed to measure the absolute concentrations of 22 elements in a group of 49 colourless sheet, container and tableware glasses of refractive index 1.5177-1.5183. The elements determined were: Al, As, Ba, Ca, Ce, Co, Cr, Cs, Eu, Fe, K, La, Li, Mg, Mn, Na, Rb, Sc, Sr, Th, U and Zn. The data have been examined by cluster analysis and stepwise discriminant analysis and recommendations are made concerning the best elements to determine for the forensic purpose of achieving satisfactory classification of the samples analysed. 23 references, 8 figures, 5 tables.

50295 **Constant-current potentiometric titration of orthophosphate with cetylpyridinium chloride: a feasibility study.** Selig, W. (Lawrence Livermore National Lab., CA). *Talanta;* **30**: No. 9, 695-698(1983). Contract W-7405-ENG-48.

The feasibility of constant-current potentiometric titration of orthophosphate with cetylpyridinium chloride has been studied. The phosphate solution is acidified with hydrochloric acid to pH 1.1-1.3 and an excess of molydate solution added. For 1 mg of phosphorus (as phosphate) the optimum Mo:P ratio is about 40. Cetylpyridinium chloride reacts stoichiometrically with 12-molybdophosphate, in 3:1 ratio. The optimum cathodic polarizing current is 1.1 μA. The blanks for molybdate are relatively small, constant and non-stoichiometric. 27 references, 1 figure, 2 tables.

4002 Inorganic And Physical Chemistry

REFER ALSO TO CITATION(S) 4002049368, 49579, 50151, 50322, 50323, 50324, 50331, 50332, 50333

50296 **(BMFT-FB-T—84-117) Development of particle-sizing for high concentrated colloidal dispersions based on photon correlations spectroscopy.** Wagner, J. (Bayer A.G., Leverkusen (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jun 1984. 168p. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number DE84752158.

Particle-sizing in colloidal dispersions by dynamic light scattering is restricted to the low-concentration regime. This report shows the development of the above mentioned technique to very high concentrations. The apparatus consists in the main part of a fiber-optic spectrometer; data acquisition and interpretation in done conventionally. The apparent systematic deviations of the particle diameter - evaluated from the diffusion coefficient - to the real particle size as a function of particle concentration is up to a high con-

centration due to particle-particle-interaction. The described experimental technique enables the measurement of particle diffusion coefficients even in very high concentrated colloidal dispersions.

50297 **(CONF-840807—5) Enthalpy of formation of americium sesquioxide; systematics of actinide sesquioxide thermochemistry.** Morss, L.R.; Sonnenberger, D.C. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000081.

From Conference on thermodynamics; Hamilton, Canada (13 Aug 1984).

The enthalpy of formation of hexagonal Am_2O_3 at 298.15 K has been determined to be -1690.4 +- 7.9 kj mol^{-1} by solution microcalorimetry. Systematic comparison of the measured enthalpies of formation of hexagonal Pu_2O_3 and Am_2O_3, monoclinic Cm_2O_3, and all lanthanide sesquioxides has been utilized to develop a predictive understanding of stability relationships among all actinide sesquioxides and other actinide species.

50298 **(CONF-8409140—2) High temperature aqueous solutions and energy considerations - physical chemical studies.** Marshall, W.L. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001544.

From International conference on the properties of steam; Moscow, USSR (3 Sep 1984).

Recent studies of high temperature aqueous systems are presented, some of which are directly applicable to the design and operation of steam generators. These studies include: (1) the phase behavior of some substances [SiO_2, Na_2SO_4, Na_2HPO_4, K_2HPO_4] that could possibly precipitate from steam when for example the substance is concentrated in metal crevices, (2) the boiling point elevation of natural solution mixtures, and (3) the ion-product and (4) specific electrical conductance of pure water. Determinations and correlations of ionization equilibria are presented for calculations of the concentrations of species present in water and steam. Fundamental approaches for the application of the results allow wide predictabilities. The studies have been used for the design and operation of geothermal power steam generators [to prevent scale formation of amorphous silica solids upon cooling of hydrothermal natural waters] and for direct application to fossil fuel and nuclear power steam generators.

50299 **(DOE/PC/60044—T1) New and improved dispersion and recovery techniques for slurry phase catalysis. Quarterly report, October 1, 1983-December 31, 1983.** (Auburn Univ., AL (USA). Dept. of Chemical Engineering). 1983. Contract AC22-83PC60044. 22p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84017334.

This quarterly report covers an extensive review of the literature in the area of catalyst deactivation and regeneration. The literature review, which is presented here in three sections, namely, carbonaceous deposit formation, metal deposit formation and methods of analysis and regeneration, served as an invaluable aid in the initiation of experimental work required to fulfill the task objectives. Since the literature survey is applicable to all five tasks, no attempt has been made to divide it in terms of contract tasks. 21 references.

50300 **(INER—0494) Laboratory scale studies of $SiHCl_3$ synthesis.** Hwang, T.L.; Hsieh, H.H. (Institute of Nuclear Energy Research, Lung-Tan (Taiwan). Technical Information Center). Mar 1983. 24p. (In Chinese). NTIS (US Sales Only), PC A02/MF A01. File Number DE85900133.

Laboratory scale preparation of $SiHCl_3$ was studied by chlorination of MG-Si with anhydrous hydrogen chloride gas in terms of the effects of temperature, HCl flow rate, silicon particle size, silicon packing height, catalyst and reaction time under 1 atm argon pressure in a 34 m/m x 60 cm fluidized bed reactor. Some of the results with discussions are presented in this report.

50301 **(LBL—18183) Thermodynamic properties of aqueous NaCl from 273 to 823 K with estimates for higher temperatures.** Pitzer, K.S. (Lawrence Berkeley Lab., CA (USA)). Jul 1984. Contract AC03-76SF00098. 42p. (CONF-8409140—1). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85000392.

From International conference on the properties of steam; Moscow, USSR (3 Sep 1984).

Equations based on theory, to the degree feasible, are developed which represent the various thermodynamic properties of aqueous NaCl. In the range 273 to 573°K, 0 to 1 kbar, and to saturation molality, the experimental data base is excellent. An equation based on a virial expansion and a Debye-Hueckel term represents the data accurately. This form of equation has been generalized to multicomponent systems; hence these results are readily extended to complex brines as the properties for other components become known. In the range above 573°K the data are more limited and of less accuracy, but a comprehensive treatment is still possible. The equation is one used before for ionic systems miscible to a fused salt. The supercooled liquid NaCl is taken as a reference state. The equation is valid from 423 to 823°K and thus has an extensive overlap with the lower-temperature equation. Estimates are also presented for temperatures above 823°K.

50302 **(LBL—18297) Kinetics of oxygen exchange between bisulfite ion and water as studied by oxygen-17 nuclear magnetic resonance spectroscopy.** Horner, D.A. (Lawrence Berkeley Lab., CA (USA)). Aug 1984. Contract AC03-76SF00098. 232p. NTIS, PC A11/MF A01; GPO Dep. File Number DE85001866.

Thesis.

The nuclear magnetic relaxation times of oxygen-17 have been measured in aqueous sodium bisulfite solutions in the pH range from 2.5 to 5 as a function of temperature, pH, and S(IV) concentration, at an ionic strength of 1.0 m. The rate law for oxygen exchange between bisulfite ion and water was obtained from an analysis of the data, and is consistent with oxygen exchange occurring via the reaction $SO_2 + H_2O$ right reversible $H^+ + SHO_3^-$. The value of k/sub -1/ is in agreement with relaxation measurements. Direct spectroscopic evidence was found for the existence of two isomers of bisulfite ion: one with the proton bonded to the sulfur (HSO_3^-) and the other with the proton bonded to an oxygen (SO_3H^-). (The symbol SHO_3^- in the above chemical equation refers to both isomeric forms of bisulfite ion.) The relative amounts of the two isomers were determined as a function of temperature, and the rate and mechanism of oxygen exchange between the two was investigated. One of the two isomers, presumably SO_3H^-, exchanges oxygens with water much more rapidly than does the other. A two-pulse sequence was developed which greatly diminished the solvent peak in the NMR spectrum.

50303 **(UCRL—90401) Kitchensink titrations.** Selig, W.S. (Lawrence Livermore National Lab., CA (USA)). Sep 1984. Contract W-7405-ENG-48. 12p. (CONF-8409136—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017452.

From Joint Army-Navy-NASA-Air Force propellent characterization subcommittee meeting; Colorado Springs, CO, USA (24 Sep 1984).

While most laboratories use more and more expensive equipment for their analyses, this speaker insists on delaying progress by using ultrasimple equipment, available in any laboratory, to perform potentiometric titrations. While not all the data presented will be pertinent to the propellants and/or explosives analyst, we hope to demonstrate that established standard methods need not necessarily always be followd. Knives, forks, beer cans, pencils can indeed be used as potentiometric sensors. This will be shown for the titrations of fluoride vs F-precipitating species such as La^{3+}; aluminum vs fluoride (pertinent to propellants); phosphate vs Pb^{2+}, La^{3+}, Ce^{3+}; phosphate vs Pb^{2+}, La^{3+}, Ce^{3+}; halides vs Ag^+; and sulfate vs Ba^{2+} and Pb^{2+}.

50304 Extended x-ray absorption fine structure in photoelectron emission. Rothberg, G.M.; Choudhary, K.M.; denBoer, M.L.; Williams, G.P.; Hecht, M.H.; Lindau, I. (Stevens Institute of Technology, Hoboken, New Jersey 07030). *Physical Review Letters;* **53**: No. 12, 1183-1186(17 Sep 1984). Contract AC02-81ER10908.

We report the first definitive measurements of extended x-ray absorption fine structure (EXAFS) made by monitoring the direct photoelectron emission as a function of photon energy. We have measured EXAFS associated with the Mn 3p and F 2s core levels in evaporated films of MnF_2 and found good agreement with bulk transmission EXAFS associated with the Mn 1s level. Photoelectron EXAFS makes possible surface-sensitive structural determinations using vacuum uv radiation on a virtually unlimited range of systems.

50305 Multiple luminescence from borohydridobis(triphenylphosphine) copper(I). Segers, D.P.; DeArmond, M.K.; Grutsch, P.A.; Kutal, C. (North Carolina State Univ., Raleigh). *Inorganic Chemistry;* **23**: No. 18, 2874-2878(29 Aug 1984). Contract FG02-79ER10540.

Low-temperature (77 K) luminescence spectra and lifetimes have been measured for the $Cu(PPh_3)_2BH_4$ (PPh_3 is triphenylphosphine) and $Cu(prophos)BH_4$ (prophos is 1,3-bis(diphenylphosphino)propane) complexes. $Cu(PPh_3)_2BH_4$ exhibits multiple emission from ^{3}IIII* and $^3(\sigma$-a/sub $\pi/)$ excited states in appropriate solvents, while $Cu(prophos)BH_4$ shows only a single $^3(\sigma$-a/sub $\pi/)$ emission in most of the solvents chosen for this study. The electronic transition associated with the σ-a/sub $\pi/$ assignment is analogous to the l-a/sub $\pi/$ transition for the free phosphine ligand. These unique emission results are discussed in terms of intramolecular and intermolecular (solvent-solute) effects. 23 references, 4 figures, 2 tables.

50306 Studies of the aqueous chemistry of fluorine and hypofluorous acid. Appelman, E.H.; Thompson, R.C. (Argonne National Lab., IL). *Journal of the American Chemical Society;* **106**: No. 15, 4167-4172(25 Jul 1984). Contract W-31-109-ENG-38.

This paper elucidates a prominent feature of the fluorine-water reaction: the production of H_2O_2 and O_2. Because this process almost certainly involves the intermediate formation of HOF, the production and consumption of H_2O_2 in the reaction of HOF with water and the mechanism of the HOF-H_2O_2 reaction are also examined. In addition, an order-of-magnitude estimate of the rate of the homogeneous reaction of F_2 with water is obtained and the effects of various added substrates are determined. 34 references, 2 figures, 5 tables.

50307 Trigonal-bipyramidal methyl group bridging two zirconocene-ketene centers. Waymouth, R.M.; Santarsiero, B.D.; Grubbs, R.H. (California Inst. of Tech., Pasadena). *Journal of the American Chemical Society;* **106**: No. 14, 4050-4051(11 Jul 1984).

In an attempt to activate zirconocene ketene complexes, a toluene solution of complex I was treated with 1 equiv of trimethylaluminum. The intermediate which formed rearranged itself to a symmetrical comples, II. Crystals suitable for an x-ray diffraction study were obtained. The molecular structure of II is shown and relevant bond angles and bond lengths are presented. The bridging methyl hydrogens were located from a difference map and refined to a final R = .081. Data analysis shows that the bridging methyl group is nearly planar, approaching a trigonal-bipyramidal configuration. The methyl bridge is 0.1 A closer to Zr(2) than to Zr(1). The Zr-C-Zr angle is not 180° as might be expected for such a carbon configuration. It is 147.8(3)°, and is attributed to the disposition of the zirconium bonding orbitals. The results suggest that the trigonal-bipyramidal geometry is a stable configuration for carbanions in the coordination sphere of Lewis acid metals. 12 references, 3 figures.

50308 Observation of a disordered spin-flop phase in Fe/sub 0.725/Co/sub 0.275/Cl_2. Wong, P.; Cable, J.W. (Schlumberger-Doll Research, P.O. Box 307, Ridgefield, Connecticut 06877). *Physical Review [Section] B: Condensed Matter;* **30**: No. 1, 485-488(1 Jul 1984). Contract W-7405-ENG-26.

The T-H phase diagram of the random antiferromagnet Fe/sub 0.725/Co/sub 0.275/Cl_2 is investigated by neutron scattering for applied field H parallel to the c axis (the direction of average anisotropy). We find an unusual disordered spin-flop phase in high fields in which the spins formed finite-size domains with their moments perpendicular to H. We argue that the disorder is a consequence of the random off-diagonal exchange interactions and the spin-flop phase is probably a realization of the three-dimensional XY model in random fields.

50309 Method of separating boron isotopes. Jensen, R.J.; Cluff, C.L.; Hayes, J.K.; Thorne, J.M. (to Dept. of Energy). US Patent 4,447,303. 8 May 1984. Filed date 23 Jan 1981. vp.

PAT-APPL-228036.

A method of boron isotope enrichment involving the isotope preferential photolysis of (2-chloroethenyl)dichloroborane as the feed material. The photolysis can readily be achieved with CO_2 laser radiation and using fluences significantly below those required to dissociate BCl_3.

50310 Isothermal equilibrium pressures of a Y-Nb alloy-H_2 system. Tanase, M.; Fisher, P.W.; Watson, J.S. (Oak Ridge National Lab., TN (USA)). *Journal of the Less-Common Metals;* **99**: No. 1, 23-31(May 1984).

The isothermal equilibrium pressures of a Y-Nb alloy-H_2 system were measured as a function of the atomic composition [H]/[Y + Nb] in the temperature range 100-890°C. The results showed that the yttrium and niobium components sorbed hydrogen independently. The equilibrium pressure P in torrs of the plateau region in the Y-H_2 system could be expressed by (T is in kelvins) log P = -11840/T + 10.52.

50311 Calcium hydroxide isotope effect in calcium isotope enrichment by ion exchange. Jepson, B.E.; Shockey, G.C. (Monsanto Research Corp., Miamisburg, OH). *Separation Science and Technology;* **19**: No. 2-3, 173-181(1984). Contract AC04-76DP00053.

The enrichment of calcium isotopes has been observed in ion-exchange chromatography with an aqueous phase of calcium hydroxide and a solid phase of sulfonic acid resin. The band front was exceedingly sharp as a result of the acid-base reaction occuring at the front of the band. Single-stage separation coefficients were found to be epsilon(^{44}Ca/^{40}Ca) = 11 x 10^{-4} and epsilon(^{48}Ca/^{40}Ca) = 18 x 10^{-4}. The maximum column separation factors achieved were 1.05 for calcium-44 and 1.09 for calcium-48 with the heavy isotopes enriching in the fluid phase. The calcium isotope effect between fully hydrated aqueous calcium ions and undissociated aqueous calcium hydroxide was estimated. For the calcium-44/40 isotope pair the separation coefficient was 13 x 10^{-4}. 20 references, 2 figures.

50312 Molecular dynamics calculations of MAX_4 melts. Saboungi, M.L.; Blander, M.; Rahman, A. (Argonne National Laboratory, Argonne, IL). *Proceedings - Electrochemical Society;* **84-2**: 1-11(May 1983). (CONF-8305100—).

From 4. Electrochemical Society international symposium on molten salts; San Francisco, CA, USA (8 May 1983).

Molecular dynamics calculations for MAX_4 melts are reported for two different sets of cation/anion radius ratios which were chosen so as to emulate melts such as chloroaluminates and fluoroyttriates. The results are expressed as radial distribution functions, the angular distributions of selected triplets and the number of ions which have particular integer values of the coordination numbers. For the small radius ratio, the A^{+3} ion is tetrahedrally coordinated and the structure of this completely ionic melt is consistent with the presence of X^-, AX^-_4, $A_2X^-_7$ and $A_3X^-_{10}$ species which equilibrate by the reactions $2AX^-_4 \rightleftharpoons A_2X^-_7 + X^-$ and $3AX^-_4 \rightleftharpoons A_3X^-_{10} + 2X^-$. For the large radius ratio, the A^{+3} cations

are mostly octahedrally coordinated and there is considerable bridging between AX /SUP 3-n/ /SUB n/ moieties which leads to a tendency for long range order.

50313 **Chemical reactions among the components in $SbCl_3$-$AlCl_3$-Sb melts.** Smith, G.P.; Buchanan, A.C.; Mamantov, G.; Sorlie, M. (Chemistry Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee). *Proceedings - Electrochemical Society;* **84-2**: 109-120(May 1983). (CONF-8305100—).

From 4. Electrochemical Society international symposium on molten salts; San Francisco, CA, USA (8 May 1983).

Although mixtures of $SbCl_3$, $AlCl_3$ and Sb metal are unreactive and mutually insoluble in the solid state, the electrical conductivity of molten $SbCl_3$-$AlCl_3$ mixtures and the substantial solubility of Sb metal in these molten mixtures show that reactions occur in the liquid state. The authors review research on these and related subjects in an effort to gain insight into what the underlying reactions might be.

50314 **Theoretical study of the reaction of AlF^-_b and $AlCl^-_4$ with oxide and sulfide ions.** Curtiss, L.A.; Blander, M. (Chemical Technology Div., Argonne National Laboratory, Argonne, IL). *Proceedings - Electrochemical Society;* **84-2**: 225-233(May 1983). (CONF-8305100—).

From 4. Electrochemical Society international symposium on molten salts; San Francisco, CA, USA (8 May 1983).

Ab initio quantum mechanical calculations were performed, using the 3-21G extended basis set, on reactions of molecules and ions containing Al-F or Al-Cl bonds with oxygen or sulfur containing species to form products with Al-O or Al-S bonds; from these we deduce the structures of the species and the energetics of the reactions. The results provide evidence for the stability of Al-O and Al-S bonds in molten salts. In addition, this study shows that (1) it may be possible to create simple ionic pair potentials to simulate Al-O and Al-S bonds in a molecular dynamics calculation and (2) that quantum mechanical calculations can provide useful information on the structures and energetics of species in molten salt solutions.

50315 **Synthetic metals based on tetramethyltetraselenafulvalene(TMTSF): varied anisotropy in the low temperature (125K) structures of $(TMTSF)_2X$, X = $C10_4^-$, PF_6^-, and AsF_6^-.** Beno, M.A.; Williams, J.M.; Lee, M.M.; Cowan, D.O. (Argonne National Lab., IL). *Solid State Communications;* **44**: No. 8, 1195-1198(1982). Contract W-31-109-ENG-38.

The low temperature (125K) x-ray crystal structures of [(tetramethyltetraselenafulvalene)$_2$X] $(TMTSF)_7X$, X=$C10_4^-$, PF_6^-, and AsF_6^- reveal decreases in the intermolecular inter- and intrastack Se-Se contact distances upon cooling (298K to 125K) which are highly anisotropic and different from one salt to another. The changes in the interstack distances, which are normal to the stacking direction, are approximately twice those involving intrastack Se-Se interactions. These observations establish that the anisotropic structural changes which accompany decreased temperature are common to numerous $(TMTSF)_2X$ radical cation conducting salt. 12 references, 2 figures, 2 tables.

4003 Organic Chemistry

REFER ALSO TO CITATION(S) 40030049447, 50292, 50305, 50307, 50315

50316 **(CONF-8409153—1) Solvent fermentations of pulp streams and their constituents.** Griffith, W.L.; Compere, A.L. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000913.

From TAPPI research and development conference; Appleton, WI, USA (30 Sep 1984).

A number of industrial solvents, including C_2 to C_5 mono- and di-hydric alcohols and corresponding ketones, can be made by bacterial fermentation of pulp streams and their constituent carbohydrates. Most of these fermentations are reported to have been performed by members of the genus Clostridium, obligate gram positive anaerobic bacilli, although some, generally dihydric alcohol fermentations, are performed by Klebsiella. Solvents fermentations have been used historically since 1916, with periods of concentrated industrial development coinciding with major wars. Historically, the fermentation feedstocks have varied to include most of the common grains, vegetables, fruits, and nuts; however, the bacterial strains used for these fermentations are able to metabolize the materials found in pulping streams ranging from weak acid sulfite liquor to wood hydrolyzate to cellulose. It appears that these organisms will be likely to find use as fermentation agents for various wood and pulp streams with appropriate strain and bioprocess development. Methods for selecting and maintaining cultures are discussed.

50317 **(DOE/ER/13004—2) Light scattering studies of lower dimensional colloidal particle and critical fluid systems.** O'Sullivan, W.J.; Mockler, R.C. (Colorado Univ., Boulder (USA)). Sep 1984. Contract AC02-82ER13004. 16p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002087.

The authors have studied the response to compression of colloidal particle crystals in monolayers on the surface of water. The crystals deform elastically as the crystals are compressed in a Langmuir trough from a lattice spacing of ten microns to spacings less than two microns. A phase transition to a close packed triangular lattice phase occurs at very high densities, when the attractive van der Waals/steric interations between particles dominate. The authors have found that the aggregates formed, when a colloidal particle monolayer coagulates following switching off of the repulsive electric dipole-dipole interactions, show scale invariance with a fractal dimension consistent with the prediction of a theory of diffusion limited aggregation in two dimensions. The authors have made progress toward the development of a computer processed array detector-spectrometer to be used in studies of melting and crystallization of two dimensional colloidal particle films. Stable black bilipid membranes have been produced, both spherical and planar, with and without embedded microparticles. We have modified our heterodyne autocorrelation spectrometer, used for studies of the dynamic response of critical fluid films, to enable us to measure the intensity autocorrelation of light scattered at forward angles. Rayleigh linewidth data has been gathered from a 1.9 micron film of a 2,6-lutidine+water critical mixture, taken at a scattering angle of ten degrees. The preliminary results indicate that the film dynamical response remains that of an equivalent three dimensional system, in apparent disgreement with recent theoretical predictions of Calvo and Ferrell.

50318 **(DOE/EV/04321—T2) Molecular beam electric resonance study of the ground and excited states of cyano acetylene.** DeLeon, R.L.; Muenter, J.S. (Rochester Univ., NY (USA). Dept. of Chemistry). 1984. Contract AC02-77EV04321. 13p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002099.

Cyanoacetylene was studied using molecular beam electric resonance spectroscopy. Ground state results are: μ=3.73172 D, eQq=4319.24 kHz, C/sub N/=0.976 kHz. Zero field spectra were observed for the 3 singly excited bending modes and Stark data were taken for the lower energy 2 of these 3 states. Excited state results include nu_7; μ=3.7225 D, eQq/sub aa/=-4302.0 kHz, eQ(q/sub bb/-q/sub cc/)=-28.8 kHz, C/sub N/(J=2)=1.47 kHz; nu_6; μ=3.7263 D, eQq/sub aa/=-4369.7 kHz, eQ(q/sub bb/-q/sub cc/)=177.1 kHz, C/sub B/(J=2)=1.30 kHz; nu_5; eQq/sub aa/=-4325.7, eQ(q/sub bb/-q/sub cc/)=96.8 kHz, C/sub N/(J=2)=1.33 kHz. l-doubling constants were also obtained for the degenerate vibrations.

50319 **(SI-R—820116-1) Kinetics - studies I. Model experiments with dehydrogenation of propane and isomerization of pentane.** Ofstad, E.B. (Sentralinstitutt for Industriell Forskning, Oslo (Norway)). Jan 1983. 70p. (In Norwegian). NTIS (US Sales Only), PC A04/MF A01. File Number DE84751649.

Introductory experiments with n-pentane isomerization proved this system unsuited for a model study. Further work was carried out by using as model system the dehydrogenating of propane with Pt/Sn on silica as catalyst. The reaction order for propane and hydrogen, the reaction constant and the activation energy

for the system was determined. Rate expressions for different possible reaction mechanisms were deducted and tested in relation to experimental data. The results fitted well to a reaction mechanism where the surface reaction determines the rate and dehydrogenation occurs in 2 steps by liberation of one H-atom at the time. It was impossible by curve fittings to determine which of the 2 steps were rate determining. However, the adsorption constant values determined from the expressions, did indicate that the liberation of the first H-atom determines the rate. The rate expression for this mechanism and the numerical values of the constants in the expression was determined. The reliability of the results depend on 2 factors. Firstly there is an uncertainty related to the experimental determination of the catalyst deactivation during the experiments and secondly there is an uncertainty in testing how the various mathematical expressions fit to the experimental data. The uncertainty introduced by the catalyst deactivation may be reduced by using reference measurements. As tothe fitting of the curves, a better method is recommended than used in this work. Appendix 4 gives results for the isomerization of pentane, the dehydrogenation of propane and the fitting of various rate expressions to the data and lastly the calculation of the rate and adsorption constants for two mechanisms. 39 figures, 13 tables.

50320 **Synchrotron x-ray study of the orientational ordering D2-D1 structural phase transition of freely suspended discotic strands in triphenylene hexa-n-dodecanoate.** Safinya, C.R.; Liang, K.S.; Varady, W.A.; Clark, N.A.; Andersson, G. (Exxon Research and Engineering Company, Corporate Research Science Laboratories, Annandale, New Jersey 08801). *Physical Review Letters;* **53**: No. 12, 1172-1175(17 Sep 1984).

We demonstrate the feasibility of x-ray scattering studies of freely suspended strands of discotic liquid crystals (of triphenylene hexa-n-dodecanoate). We are able to grow strands, which are stable for days, of diameter >50 μm with a few single crystal domains. Unexpectedly, we find that the quasi two-dimensional structural phase transition from columnar D2 to columnar D1 corresponds to the orientational ordering of columns of molecules with the molecules tilted at finite angles to the column axis in both phases.

50321 **Reactive scattering of O(^{3}P) with toluene.** Baseman, R.J.; Buss, R.J.; Casavecchia, P.; Lee, Y.T. (Univ. of California, Berkeley). *Journal of the American Chemical Society;* **106**: No. 15, 4108-4111(25 Jul 1984). Contract AC03-76SF00098.

In a crossed molecular beam study, the reaction of O(^{3}P) + toluene, at 9.7 kcal/mol collision energy, is shown to give primarily radical products, CH_3 + phenoxy and H + cresoxy, under single-collision conditions. The isotropic angular distributions of the product suggest that the mechanism involves formation of a long-lived triplet biradical intermediate. 11 references, 6 figures.

50322 **Reactions of $FeCH_3i$ and $CoCH_3^+$ with aliphatic alkanes in the gas phase.** Jacobson, D.B.; Freiser, B.S. (Purdue Univ., West Lafayette, IN). *Journal of the American Chemical Society;* **106**: No. 14, 3891-3899(11 Jul 1984). Contract AC02-80ER10689.

The gas-phase reactions of $FeCH_3^+$ and $CoCH_3^+$ with aliphatic alkanes up to C_6H3I_4 were studied. $FeCH_3^+$ is completely unreactive with the aliphatic alkanes, while $CoCH_3^+$ reacts with all alkanes larger than ethane by initial insertion into a C-H bond resulting in CH_4 loss followed by dehydrogenation or alkane elimination forming Co(allyl)$^+$ products. The Co(allyl)$^+$ ions react rapidly with the alkanes (except methane) predominantly by dehydrogenation generating allyl-olefin complexes. The results indicate that the cobalt-allyl bond strength, $D^0(Co^+\text{-}C_3H_5)$, is in excess of 72 kcal/mol while $D^0(Co^+$-butadiene) appears to be less than 52 kcal/mol. $CoCH_3^+$ also abstracts a hydride from alkanes larger than ethane (except for 2,2-dimethylpropane) forming C/sub n/ H/sub 2n + 1/ $^+$ and implying $D^0(CoCH_3\text{-}H^-)$ = 256 +/- 10 kcal/mol which together with an earlier reported value of $\Delta H/sub\ f/^0$ ($CoCH_3$) = 256 +/- 4 kcal/mol yields $D^0(CoCH_4)$ = 49 +/- 11 kcal/mol and $\Delta H/sub\ f/^0$ ($CoCH_4$) = 35 +/- 11 kcal/mol. Structures of the major primary product ions were investigated both by collision-induced dissociation (CID) and by specific ion-molecule reactions. 32 references, 7 figures, 1 table.

50323 **Reactions of $FeCH_3i$ and $CoCH_3^+$ with cyclic hydrocarbons in the gas phase.** Jacobson, D.B.; Freiser, B.S. (Purdue Univ., West Lafayette, IN). *Journal of the American Chemical Society;* **106**: No. 14, 3900-3904(11 Jul 1984). Contract AC02-80ER10689.

The gas-phase reactions of $FeCH_3^+$ and $CoCH_3^+$ with cyclic hydrocarbons (C_3 through C_6) were studied. Both $FeCH_3^+$ and $CoCH_3^+$ react with cyclopropane and cyclobutane by cleavage of the ring. For cyclopropane, insertion into a C-C bond results in initial formation of an ethyl-ethene complex which is in rapid equilibrium with hydrido-bis(ethene) complex. Elimination of ethene then yields $MC_4H_6^+$ which appears to consist of a hydrido-ethene and an ethyl complex in equilibrium. Both $FeCH_3^+$ and $CoCH_3^+$ generate stable methyl-ethene complexes with cyclobutane. No reaction is observed for $FeCH_3^+$ with either cyclopentane or cyclohexane; however, $CoCH_3^+$ is reactive with retention of the integrity of the ring structures. A Co-c-$C_5H_7^+$ species is formed which undergoes two H/D exchanges with D_2. Co-c-$C_6H_7^+$ undergoes only one H/D exchange while no exchanges are seen for Fe-c-$C_6H_7^+$ with D_2. Products corresponding to protonated ferrocene and cobaltocene are generated and readily eliminate a hydrogen atom forming the respective metallocenes in high efficiency upon collisional activation. A lower limit of 84 and 66 kcal/mol is assigned to D^0 (Co^+-c-C_5H_5) and $D^0(Fe^+$-c-C_5H_5), respectively. D^0 = metal-allyl bond strength. 28 references, 2 figures.

50324 **Arrhenius parameters for rearrangement of the neophyl, 1-indanylmethyl, 2-allylbenzyl, and 2-(2-vinylphenyl)ethyl radicals relative to hydrogen abstraction from tributylstannane.** Franz, J.A.; Barrows, R.D.; Camaioni, D.M. (Pacific Northwest Lab., Richland, WA). *Journal of the American Chemical Society;* **106**: No. 14, 3964-3967(11 Jul 1984).

The temperature dependence of rates of several radical rearrangements relative to abstraction of hydrogen atom from tributylstannane has been determined. The rearrangement of 2-phenyl-2-methylpropyl to 1-phenyl-2-methylprop-2-yl (neophyl rearrangement) relative to hydrogen abstraction is represented by log (r/M) = (2.48 +/- 0.08) - (8.13 +/-0.16)/theta, theta = 2.3 RT kcal/mol. The rearrangement of 2-allylbenzyl to 2-indanylmethyl exhibited log (r/M) = (2.32 +/- 0.16)- (10.47 +/- 0.36/theta, and the rearrangement of 2-allylbenzyl to 2-tetralyl is represented by log (r/M) = (2.18 +/- 0.28) - (12.47 +/- 0.60)/theta. The rearrangement of 1-indanylmethyl to 2-tetralyl is represented by log (r/M) = (2.65 +/- 0.12) - (11.21 +/- 0.24)/theta. Closure of 2-(2-vinylphenyl)ethyl to the five-member ring occurs with a 7.3 +/- 0.6 kcal/mol barrier and was preferred over closure to the six-member ring by 2.1 +/- 1 kcal/mol. From known or estimated rates of abstraction of hydrogen from tributylstannane, rates of rearrangement of the radicals are estimated.

50325 **Electrochemical properties of the solvent $SbCl_3$-$AlCl_3$-N-(1-BUTYL)pyridinium chloride and electrochemical and spectroelectrochemical studies of the solute 9,10-dimethylanthracene.** Chapman, D.M.; Mamantov, G.; Petrovic, C.; Smith, G.P.; Sorlie, M. (Chemistry Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee). *Proceedings - Electrochemical Society;* **84-2**: 183-195(May 1983). (CONF-8305100—).

From 4. Electrochemical Society international symposium on molten salts; San Francisco, CA, USA (8 May 1983).

Physical and electrochemical properties were determined for ternary mixtures of $SbCl_3$, $AlCl_3$ and N-(1-butyl)pyridinium chloride (BPCl) that are liquid at ambient temperatures. Specific conductivities of the compositions (mole %) 60:19:21 (basic) and 60:21:19 (acidic) $SbCl_3$-$AlCl_3$-BPCl, measured over the temperature range 24 - 100°C, varied from 0.00395 to 0.02759 S cm^{-1}. Viscosities of the 60:21:19 and 60:19:21 melts were 22.8 plus or minus 0.7 and 31.5 plus or minus 0.9 cp, respectively, at 25.1 plus or minus 0.5°C. For a potentiometric titration between the compositions 60:18:22 and 60:22:18 with $SbCl_3$ fixed at 60 mol %, the potential of the Sb(III)/Sb (0) couple increased by 0.43 V at 27°C. Current-overvoltage curves for the oxidation of antimony metal in a 60:21:19 melt at an Sb rod electrode displayed Tafel behavior. The feasibility of performing electrochemical studies in these media was demonstrated using cyclic voltammetry, differential pulse polarog-

raphy and double potential-step chronocoulometry to elucidate the electrochemical behavior of 9,10-dimethylanthracene (DMA) in the 60:19:21 melt. The solute was reversibly oxidized to its radical cation at an anodic peak potential of +0.50 V relative to the reference electrode $SbCl_3$-BPCl(l), sat. $SbCl_3$/Sb at 27°C. Spectroelectrochemical experiments on DMA using an optical multichannel spectrometer over the range 479-984 nm are reported. The spectrum of the DMA radical cation has four bands with the most intense at 678 nm.

50326 **Influence of redox and Lewis acid functions of $SbCl_3$-rich molten salt catalysts on the reactions of coal model compounds.** Buchanan, A.D.; Dworkin, A.S.; Smith, G.P. (Chemistry Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee). *Proceedings - Electrochemical Society;* **84-2**: 234-247(May 1983). (CONF-8305100—).

From 4. Electrochemical Society international symposium on molten salts; San Francisco, CA, USA (8 May 1983).

Recent studies of the chemistry of coal model compounds in $SbCl_3$-based molten salt catalysts have shown that both the redox and Lewis acid functions of these media can play principal roles in catalyzing reactions for organic substrates. These two catalytic functions are discussed in relation to two reaction types that have been recently discovered in highly purified, anhydrous $SbCl_3$-rich melts. The redox function of the melt is shown to play the dominant catalytic role in a transfer hydrogenation reaction for oxidizable arenes that are selectively hydrogenated by tetralin at only 80°C. The arene radical cation is found to serve as the key organic reactive intermediate. The Lewis acid function of the melt is shown to catalyze selective transalkylation chemistry for the α,ω-diphenylalkanes, $C_6H_5(CH_2)$ /SUB n/ C_6H_5 (n = 1-4) with the catalyst generating a benzylic carbenium ion as the key reactive intermediate.

50327 **Reactivity of anthracene in liquid $SbCl_3$-$AlCl_3$-N-(1-BUTYL)pyridinium chloride mixtures.** Zingg, S.P.; Buchanan, A.C.; Chapman, D.M.; Dworkin, A.S.; Smith, G.P.; Sorlie, M. (Chemistry Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Proceedings - Electrochemical Society;* **84-2**: 248-264(May 1983). (CONF-8305100—).

From 4. Electrochemical Society international symposium on molten salts; San Francisco, CA, USA (8 May 1983).

Mixtures of $SbCl_3$ and N-(1-butyl)pyridinium chloride (BPCl) containing 75-87 mol % $SbCl_3$ and $SbCl_3$-$AlCl_3$-BPCl mixtures containing 60 mol % $SbCl_3$ and 17-24 mol % BPCl were found to be liquid at 25°C. Dilute solutions of anthracene were stable in ternary mixtures containing 18 mol % $AlCl_3$, but in mixtures containing 22-24 mol % $AlCl_3$, anthracene reacted under the influence of the solvent, which behaved as both oxidant and H-transfer catalyst. The oxidized product was protonated anthracene, which was stable in this melt. The source of protons was provided by hydrogen-liberating Scholl condensations combined with the reduction of Sb(III). A part of the hydrogen from Scholl reactions reacted with anthracene to form 9,10-dihydroanthracene. By contrast, a liquid mixture without $SbCl_3$, $AlCl_3$-BPCl (2:1 mole ratio), proved to be a much less active H-transfer catalyst than the $SbCl_3$-rich liquids even though it is a stronger Lewis acid, and it did not induce protonation beyond a trace attributable to protic impurities.

50328 **(UCRL-Trans—11979) Concerning the question of the fluorescence yield of solutions.** Kozma, L.; Hevesi, J.; Horvai, R. Translated from *Acta Physica et Chemica ;* **10**: 79-84(1964). Contract W-7405-ENG-48. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84014017. DE84014017

The dependence of the luminescence yield on the wave length of the excitation light was investigated experimentally for five luminescent materials and the results obtained were compared with the quantum yield calculated based on the modified Stepanow relation. According to the results, more sensitive deviations from the Wawilow law can also be found for the systems investigated. The experimental and calculated functions show, except for one material, good agreement.

4004 Electrochemistry

REFER ALSO TO CITATION(S) 40040049914, 50295, 50313, 50325

50329 **(CONF-840617—8) Photoacoustic spectroscopy at electrode-solution interface.** Vallet, C.E.; Brown, G.M. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001872.

From 12. DOE surface science/SUBWOG - 7. SUBWOG - 12B technical exchange meeting; Oak Ridge, TN, USA (11 Jun 1984).

Photoacoustic spectroscopy, coupled with electrochemical measurements, can be used to monitor film formation and breakdown during corrosion passivation. A two-beam photoacoustic-electrochemical spectrometer was built. The spectrometer was tested using holmium oxide and titanium oxide, and then it was used to study the passivation of titanium in sulfuric acid solutions. 8 figures.

50330 **Chemically-modified electrodes in photoelectrochemical cells.** Fox, M.A.; Hohman, J.R.; Kamat, P.V. (Univ. of Texas, Austin). *Canadian Journal of Chemistry;* **61**: No. 5, 888-893(1893).

Tin oxide and titanium dioxide semiconductor electrodes hae been covalently modified by the attachment of functionalized olefins and arenes through surface silanation or via a cyanuric chloride linkage. The excited state and electrochemical properties of the molecules so attached are significantly affected by the semiconductor. Photocurrent measurements and time-resolved laser coulostatic monitoring have been employed to elucidate the mechanism of charge injection on these modified surfaces. 17 references, 7 figures.

50331 **Spectroscopic studies of transition metal ions in molten alkali metal carboxylates.** Maroni, V.A.; Maciejewski, M.L. (Argonne National Laboratory, Argonne, IL). *Proceedings - Electrochemical Society;* **84-2**: 359-376(May 1983). (CONF-8305100—).

From 4. Electrochemical Society international symposium on molten salts; San Francisco, CA, USA (8 May 1983).

Electronic absorption and C-13 NMR spectroscopic studies were carried out to investigate the structure of (i) alkali metal formate (Fm) and acetate (Ac) eutectic melts and (ii) solutions of 3d transition metal (TM) cations in these eutectics. Measurements were made over the temperature range 90→190°C. The most stable oxidation states of the individual TMs in the Fm and Ac eutectics were: Ti^{3+}, V^{3+}, VO^{2+}, Cr^{3+}, Mn^{2+}, Fe^{2+}, Co^{2+}, Ni^{2+}, and Cu^{2+}. The ligand field absorption spectra obtained in these carboxylate melts bore a consistent resemblance to the spectra of these same cations in aqueous media, but the absorptivities were generally higher than are observed for the hexaquo complexes. The results were interpreted in terms of the existence of bidentate coordination in some (if not all) cases, leading to noncentrosymmetric complexation geometries. Key results of the NMR measurements included the apparent observation of two different carboxylate anion environments in Ni^{2+} solutions. C-13 spin-lattice relaxation of the carboxylate anions in the TM-free eutectics was found to be controlled by dipolar coupling to another nucleus. In the TM-containing solutions, the spin-lattice relaxation times were reduced by a factor of 10 to 1000, evidencing the expected shift to electron-nuclear dipolar coupling. Activation energies for viscous flow derived from the spin-lattice relaxation measurements on TM-free melts were in the 10→11 kcal/mol range, reflecting the highly ordered, glassy nature of the eutectics studied.

50332 **The behavior of water in molten salts.** White, S.H.; Twardoch, U.M. (EIC Laboratories Inc., Newton, MA). *Proceedings - Electrochemical Society;* **84-2**: 392-402(May 1983). (CONF-8305100—).

From 4. Electrochemical Society international symposium on molten salts; San Francisco, CA, USA (8 May 1983).

The differing behavior of water equilibrated with three separate molten salt solvents is discussed with respect to the chemistry of the solutions and the electroreductive mechanisms at gold electrodes.

50333 The electrochemical behavior of sulfide ions in molten cryolite. Minh, N.G.; Yao, N.P. (Argonne National Laboratory, Chemical Technology Division, Argonne, Illinois). *Proceedings - Electrochemical Society;* **84-2**: 443-450(May 1983). (CONF-8305100—).

From 4. Electrochemical Society international symposium on molten salts; San Francisco, CA, USA (8 May 1983).

The electrochemical behavior of sulfide ions in molten cryolite (Na_3AlF_6) has been studied by cyclic voltammetry using graphite electrodes at 1323 K. The oxidation of sulfide ions is found to proceed via a quasi-reversible mechanism, i.e., one in which the current is controlled by both diffusion and charge transfer kinetics. The transfer coefficient B and the standard rate constant k /SUB s/ are estimated to be 0.5 and 0.0042 cm/sec, respectively. The apparent diffusion coefficient for sulfide ions in cryolite at 1323 K is about 3.93 x 10^{-5} cm^2/sec.

4005 Photochemistry

REFER ALSO TO CITATION(S) 40050050330

50334 (CONF-840387—10) Multiphoton ionization of benzene in solution. Siomos, K; Faidas, H.; Christophorou, L.G. (Oak Ridge National Lab., TN (USA); Tennessee Univ., Knoxville (USA). Dept. of Physics). 1984. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000893.

From 2. topical meeting on laser techniques in the extreme ultraviolet; Boulder, CO, USA (5 Mar 1984).

The multiphoton ionization spectrum of benzene in a dilute solution in n-pentane has been measured for laser excitation wavelengths from 360-560 nm. The observed spectrum, from 460-560 nm, has been measured using linearly and circularly polarized light and has been ascribed to multiphoton ionization via the two-photon resonant ^{1}B/sub 2μ/-^{1}A/sub 1g/ transitions of benzene. The order of the multiphoton ionization process has been determined, and the observed resonances in the spectral region from 360-445 nm are discussed. Power measurements at 337.1 nm indicate that two photons can ionize benzene in this energy region, giving an upper limit to the ionization threshold of benzene in n-pentane of ~7.36 eV.

50335 (LBL—18290) Polyelectrolytes as interfaces for retarding back-reaction in photoinduced electron transfer. Otvos, J.W.; Casti, T.E.; Calvin, M. (Lawrence Berkeley Lab., CA (USA)). Aug 1984. Contract AC03-76SF00098. 24p. (CONF-8409141—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85000713.

From Photochemistry of metal complexes conference; Tokyo, Japan (2 Sep 1984).

Flash photolysis experiments on the effect of the polyelectrolytes poly(styrene sulfonate) (PSS) and Poly(N,N-dimethyl-3, 5-dimethylene piperidinium chloride) (PolyP) on the photoinduced electron transfer reaction between zinc(II) tetrakis (4-N-methylpyridinium)porphyin (ZnP) and propyl viologen sulfonate (PVS^0) show that PSS decreases both the forward and back- electron transfer reaction rates significantly, by a factor of ~ 60. The effect of PSS is due to hydrophobic envelopment of ZnP by the polyelectrolyte, hindering approach of reactants to it and thus reducing all bimolecular reaction rates between ZnP and species in solution. The cationic polyelectrolyte, PolyP, decreases the back-electron transfer rate by a factor of ~ 2 without affecting other bimolecular reaction rates. This effect is probably due to binding of the PVS^- to the polyelectrolyte, which then repels the oxidized porphyrin electrostatically.

50336 Ground- and excited-state electron-transfer reactions: photoinduced redox reactions of poly(pyridine)ruthenium(II) complexes and cobalt(III) cage compounds. Mok, C.Y.; Zanella, A.W.; Creutz, C.; Sutin, N. (Brookhaven National Lab., Upton, NY). *Inorganic Chemistry;* **23**: No. 18, 2891-2897(29 Aug 1984).

Rate constants for the quenching of poly(pyridine)ruthenium(II) (RuL_3^{2+}) excited states by caged cobalt(III) amine complexes ($Co(cage)^{3+}$) range from 2 x 10^8 to 1 x 10^9 M^{-1} s^{-1} at 25°C. The quenching process involves parallel energy transfer (k/sub en/ ~ 1 x 10^8 M^{-1} s^{-1}) and electron transfer (k/sub el/ = (0.1-1) x 10^9 M^{-1} s^{-1}) from RuL_3^{2+} to $Co(cage)^{3+}$. The rate constants for electron-transfer quenching are consistent with expectations based on an adiabatic semiclassical model. The yields of electron-transfer products range from 0.3 to 1.0, increasing as the rate constants for the back-reaction of RuL_3^{3+} with $Co(cage)^{2+}$ diminish. The relatively low magnitudes of the back-reaction rate constants, (0.08-8) x 10^8 M^{-1} s^{-1}, are consistent with the high yields of electron-transfer products and derive from poor coupling of the RuL_3^{3+} and $Co(cage)^{2+}$ orbitals. 30 references, 3 figures, 4 tables.

50337 Spectral properties of protonated Schiff base porphyrins and chlorins. INDO-CI calculations and resonance raman studies. Hanson, L.K.; Chang, C.K.; Ward, B.; Callahan, P.M.; Babcock, G.T.; Head, J.D. (Brookhaven National Lab., Upton, NY). *Journal of the American Chemical Society;* **106**: No. 14, 3950-3958(11 Jul 1984). Contract AC02-76CH00016.

INDO-CI calculations successfully reproduce the striking changes in optical spectra that occur upon protonation of mono- and disubstituted porphyrin, chlorin, and bacteriochlorin Schiff base complexes. They ascribe the changes to Schiff base C=N π^* orbitals which drop in energy upon protonation and mix with and perturb the π^* orbitals of the macrocycle, a result consistent with resonance Raman data. The perturbation is predicted to affect not only transition energies and intensities but also dipole moment directions. The symmetry of the porphyrin and the substitution site of the chlorin are shown to play an important role, especially in governing whether the lowest energy transition will red shift or blue shift. Blue shifts are calculated for protonation of ketimine and enamine isomers of pyrochlorophyll a (PChl). Comparison with reported optical spectra suggests that PChl a Schiff base may undergo isomerization upon protonation. Resonance Raman data on CHO, CHNR, $CHNHR^+$, and pyrrolidine adducts of chlorin demonstrate the isolation of the peripheral C=O and C=N groups from the macrocycle π system intramolecular hydrogen bonding, and selective enhancement of v/sub C=N/ for those species with a split Soret band. V/sub C=N/ is observed with 488.0-nm excitation into the lower-energy Soret and absent for 406.7-nm excitation into the higher-energy Soret, a result predicted by the calculations. 44 references, 10 figures, 2 tables.

50338 Structure of decomposing $[C_7H_7O]^+$ ions: benzyl versus tropylium ion structures. Russell, D.H.; Freiser, B.S.; McBay, E.H.; Canada, D.C. (Texas A & M Univ., College Station). *Organic Mass Spectrometry;* **18**: No. 11, 474-485(1983).

The unimolecular dissociation reactions for $[C_7H_7O]^+$ ions generated by fragmentation of a series of precursor molecules have been investigated. TThe metastable kinetic energy values and branching ratios associated with decarbonylation and expulsion of a molecule of formaldehyde (CH_2O) from the $[C_7H_7O)^+$ ions are interpreted as the hydroxybenzyl and hydroxytropylium $[C_7H_7O]^+$ not interconverting to a common structure on the microsecond time-scale. In addition, similar measurements on protonated benzaldehyde, methylaryloxy and phenyl methylene ether $[C_7H_7O]^+$ ions are interpreted as the dominant fraction of these decomposing ions having unique structures on the microsecond time-scale. These results are supported by experimental heats of formation calculated from ionization/appearance energy measurements. The experimental heats of formation are determined as: hydroxybenzyl ions, 735 kJ mol^{-1}; hydroxytropylium ions, 656 kJ mol^{-1}; phenyl methylene ether ions, 640 kJ mol^{-1}; methylaryloxy ions 803 kJ mol^{-1}. The combination of the results reported in this paper with previously reported experimental data for stable $[C_7H_7O]^+$ ions is interpreted as evidence that the relative population of benzyl versus tropylium $[C_7H_7O]^+$ ion structures from a given precursor molecule is determined by isomerization of the parent ion and not by structural equilibration of the $[C_7H_7O^+$ ion. 32 references, 3 figures, 3 tables.

50339 Fluctuation experiments on atomic and molecular systems using the one-atom detector. Iturbe, J.; Allman, S.L.; Hurst, G.S.; Payne, M.G. (Oak Ridge National Lab., TN). *Chemical Physics Letters;* **93**: No. 5, 460-467(17 Dec 1982). Contract W-7405-ENG-26.

Fluctuation studies of atomic and molecular populations have been made by means of one-atom detection techniques. Density fluctuations of atoms and density fluctuations of molecules, as well as photoionization yield, photodissociation yield, and collisional broadening fluctuations, were studied, using appropriate laser saturation conditions. In each case it was found that the Poisson distribution described the observed frequency distributions, suggesting that the underlying assumption of random behavior is valid for all five of these physical phenomena. 11 references, 4 figures, 1 table.

50340 **Multiphoton ionization photoelectron spectroscopy: xenon and nitric oxide.** Miller, J.C.; Compton, R.N. (Oak Ridge National Lab., TN). *Chemical Physics Letters;* **93**: No. 5, 453-459(17 Dec 1982). Contract W-7405-ENG-26.

Photoelectron spectra ($\approx$ 50 meV, full width at half maximum) following resonantly enhanced multiphoton ionization of xenon and nitric oxide have been recorded and compared to the previous low-resolution ($\approx$ 120 meV) results. Several new features have been resolved and additional experiments, which include isotopic substitution and two-color multiphoton ionization, have been performed. 26 references, 2 figures.

50341 **Luminescence behavior as a probe for phase transitions and excimer formation in liquid crystals: dodecylcyanobiphenyl.** Subramanian, R.; Patterson, L.K.; Levanon, H. (Univ. of Notre Dame, IN). *Chemical Physics Letters;* **93**: No. 6, 578-581(Dec 1982).

The luminescence behavior of a liquid crystal, dodecylcyanobiphenyl, as a function of temperature, is reported. The fluorescence intensity exhibits discontinuities at temperatures which correspond to the phase transitions: crystalline - smectic - isotropic. The results are interpreted in terms of singlet monomer and excimer formation. 14 references, 3 figures.

50342 **Rate determination for F + CH_4 by real-time competitive kinetics.** Fasano, D.M.; Nogar, N.S. (Univ. of Nebraska, Lincoln). *Chemical Physics Letters;* **92**: No. 4, 411-414(29 Oct 1982).

The rate constant for the title reaction was found to be (5.72 +/- 0.30) x 10^{-11} cm^3 $molecule^{-1}$ s^{-1}. Fluorine atoms were generated via IR multiphoton dissociation of SF_6 in a mixture of CH_4, D_2, and Ar. The time-dependent concentration of fluorine atoms, and hence the rate of reaction, could be monitored either by HF IR luminescence or by DF luminscence. We have thus established that real-time observation of competitive kinetics can be used to measure a variety of reaction rates. 17 references, 2 figures.

50343 **Wavelength effects on ionic photodissociation of charge-transfer complexes: the quadricyclene system.** Jones, G. II; Becker, W.G. (Boston Univ., MA). *Chemical Physics Letters;* **85**: No. 3, 271-274(15 Jan 1982).

Irradiation of charge-transfer (CT) complexes of quadricyclene results in isomerization to norbornadiene with quantum efficiencies which increase at shorter excitation wavelengths. The wavelength dependence is interpreted in terms of ionic photodissociation from upper vibrational levels of the excited CT state. 20 references, 1 figure, 1 table.

50344 **(KFK-tr—687) Kinetics of the photoprotolytic reaction in a solution of coumarin dye.** Derkacheva, L.D.; Krymova, A.I.; Petukhov, V.A.; Platonov, N.S. Translation of *Optika i Spektroskopiya ;* **53**: No. 1, 73-78(1982). 13p. (In German). Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Stabsabteilung Internationale Beziehungen.

The radiation kinetics of various ionic forms of the conmarin dye, aesculin, in ethanol under addition of acid was studied with the aid of a photoelectric rapid convertor (probably a photomultiplier with coupled oscillograph). The sweeps of radiation intensity were determined for sub-nanosecond resolution time. It was shown that the proton addition reaction from solution can be described by a simple one-step scheme. Rate constants for the photoprotolytic reaction were calculated from the measured time dependences of radiation intensity.

50345 **Singlet sensitization of the norbornadiene rearrangement: excitation energy cascade potentially involving triplet exciplexes.** Jones, G. II; Xuan, P.T.; Schwarz, W. (Boston Univ., MA). *Tetrahedron Letters;* **23**: No. 52, 5505-5508(1982).

Valence isomerization of dimethyl bicyclo[2.2.1]hepta-2,5-diene-2,3-dicarboxylate is induced on quenching the fluorescence of a variety of sensitizers. Quantum efficiencies for rearrangement depend on the triplet energy of the sensitizer.

4006 Radiation Chemistry

REFER ALSO TO CITATION(S) 40060049497, 50513, 50748

50346 **(CONF-8409152—1) Picosecond pulse radiolysis studies to understand the primary processes in radiolysis.** Jonah, C.D.; Lewis, M.A. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000099.

From 3. working meeting on radiation interaction; Leipzig, F.R. Germany (24 Sep 1984).

The use of pulse radiolysis to learn about processes which occur before the beginning of chemical times is discussed. Two examples, the distance distribution of positive and negative ions in hydrocarbons, and the state of the dry electron are discussed in detail.

50347 **(OEFZS—4165) Radiation-curable impregnating agents for the conservation of archaelogic wooden objects.** Schaudy, R.; Wendrinsky, J.; Kalteis, H.; Grienauer, W. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). May 1982. 31p. (In German). (CH—307/82). NTIS (US Sales Only), PC A03/MF A01. File Number DE84703127.

Impregnating agents curable by ionizing radiation, such as free radical polymerizable monomers and monomer mixtures of artificial resins (dissolved in monomers), have been investigated. Specific weight and viscosity of the liquid mixtures have been determined. Applying increasing gamma doses the curing has been followed. Specific weight and gel content of the cured samples have been determined, and their hardness and elastic properties have been estimated. From the change in specific weight during hardening the shrinkage can be deduced. The results are to be discussed.

50348 **(OEFZS—4195) Radiation-curable impregnating agents for the conservation of archaeologic wooden objects. Part 2.** Schaudy, R.; Wendrinsky, J.; Kalteis, H.; Grienauer, W. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). Dec 1982. 32p. (In German). (CH—313/82). NTIS (US Sales Only), PC A03/MF A01. File Number DE84703128.

As a continuation of the work described in OEFZS Ber. No. 4165, impregnating agents curable by ionizing radiation, such as free radical polymerizable monomers or artificial resins, have been investigated. Specific weight and viscosity of the liquid mixtures have been determined as well as the specific weight and gel content of the gamma radiation-cured samples. Hardness and elastic behaviour have been estimated only. The shrinkage during hardening was found to be 5 to 12 % for low viscous mixtures (up to 600 mPa.s) and 3 to 8 % for higher viscous impregnating agents. The results are to be discussed.

4007 Radiochemistry And Nuclear Chemistry

REFER ALSO TO CITATION(S) 40070049521, 50216, 50595, 50821

50349 (INIS-mf—9052, pp 35) **Model for the mechanism of stabilization of the Mn-56 "hot" atom and the obtaining of its different valent forms through the (n,) reaction in solid $KMnO_4$.** Kosev, N. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). 1983. (In Bulgarian). NTIS (US Sales Only), PC A99/MF A01. File Number TI84780548. (CONF-8309253—Absts.).

From 1. national congress of the physicists in Bulgaria; Sofia, Bulgaria (28 Sep 1983).

50350 **(ORNL—5992) Transuranium Processing Plant report of production, status, and plans for October 1, 1980-March 31, 1983.** King, L.J.; Benker, D.E.; Bigelow, J.E. (Oak Ridge National Lab., TN (USA)). Oct 1984. Contract AC05-84OR21400. 30p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85001493.

Operations during this report period are summarized, and the amounts of materials obtained and shipped are listed. Proposed processing schedules and anticipated yields of various products in the near future are outlined. The original and current contents (^{252}Cf and ^{248}Cm) of existing neutron sources made at TRU, as well as the individuals to whom these sources are currently loaned, are tabulated. Also, a variety of special projects that required use of the facilities available at TRU are described.

50351 **(PINSTECH/RIAD—102) Program for TI programmable 59 calculator for calculation of ^{3}H concentration of water samples.** Hussain, S.D.; Asghar, G. (Pakistan Inst. of Nuclear Science and Technology, Rawalpindi. Radiation and Isotope Applications Div.). Sep 1982. 40p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84703181.

A program has been developed for TI Programmable 59 Calculator of Texas Instruments Inc. to calculate from the observed parameters such as count rate etc. the ^{3}H (tritium) concentration of water samples processed with/without prior electrolytic enrichment. Procedure to use the program has been described in detail. A brief description of the laboratory treatment of samples and the mathematical equations used in the calculations have been given.

50352 **(PINSTECH/RIAD—103) Exploration for tritium-free water.** Hussain, S.D. (Pakistan Inst. of Nuclear Science and Technology, Rawalpindi. Radiation and Isotope Applications Div.). Oct 1982. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703131.

Tritium-free water is generally required in large quantities for the preparation of laboratory tritium standards as well as blanks which are used to determine background count rate in the measurement of low level tritium concentrations in water samples by liquid scintillation counting method. In order to meet the requirements of tritium-free water and save the recurring expenditure on its import from abroad, exploration for locating its source in the country was undertaken. Water samples collected from a few possible sources were analysed precisely for their tritium content at the International Atomic Energy Agency, Vienna, Austria and a source of tritium-free water was determined.

50353 **(PINSTECH/RIAD—104) Purification of tritium-free water.** Hussain, S.D. (Pakistan Inst. of Nuclear Science and Technology, Rawalpindi. Radiation and Isotope Applications Div.). Oct 1982. 9p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703132.

Ground water which has been out of contact with the atmosphere for a long time as compared to the half life of tritium (12.43 years) does not contain any measureable amount of tritium. Such water is called tritium-free water. It may contain dissolved and suspended impurities and has to be purified before it can be used for the preparation of blanks and standards required in the routine measurement of low level tritium in water samples. The purification of tritium-free water by distillation in a closed system has been described. The quality of processed tritium-free water was precisely checked at International Atomic Energy Agency (IAEA) Vienna and found satisfactory.

50354 **Isothiocyanato complex of technetium(II). Spectroelectrochemical and single-crystal x-ray structural studies on trans-[Tc(DPPE)$_2$(NCS)$_2$]^0, where DPPE = 1,2-bis(diphenylphosphino)ethane.** Bandoli, G.; Mazzi, U.; Ichimura, A.; Libson, K.; Heineman, W.R.; Deutsch, E. (Univ. of Cincinnati, OH). *Inorganic Chemistry;* **23**: No. 18, 2898-2901(29 Aug 1984). Contract AC02-80EV10380.

The air-stable technetium(II) complex trans-[Tc(DPPE)$_2$(NCS)$_2$]^0, where DPPE represents 1,2-bis(diphenylphosphino)ethane, has been characterized by single-crystal x-ray structural analysis refined to a conventional R factor of 0.069. Rose-colored crystals of this material, fw 1012.01, crystallize in the triclinic space group P1 with a = 21.384 (6) A, b = 12.878 (5) A, c = 9.549 (4) A, α = 71.51 (3)°, β = 81.94 (4)°, and Z = 2. In this complex the technetium(II) center is approximately octahedrally coordinated with four equatorial P atoms at an average distance of 2.44 (1) A and two trans axial N-bonded NCS$^-$ ligands at 2.04 (2) A. Spectroelectrochemical investigation of this complex shows that it undergoes reversible 1-equiv reduction to the Tc(I) anion and reversible 1-equiv oxidation to the Tc(III) cation, all three species being stable on the time scale of hours. The E°' values (0.50 M tetraethylammonium perchlorate in N,N-dimethylformamide) for the Tc(III)/Tc(II) and Tc(II)/Tc(I) couples are 0.392 and -0.601 V vs. Ag/AgCl, respectively. Relative to chloro or bromo ligands, in the analogous trans-[Tc(DPPE)$_2$X$_2$]/sub /+/ 0/-/ (X = Cl, Br) complexes, the N-bonded NCS$^-$ ligand markedly stabilizes the lower oxidation states. This effect and the dependence of the Tc-P bond length on the technetium oxidation state are discussed in terms of π back-bonding. 25 references, 3 figures, 2 tables.

50355 **^{18}F-4-fluoroantipyrine.** Shiue, C.Y.; Wolf, A.P. (to Dept. of Energy). US Patent 4,436,717. 13 Mar 1984. Filed date 29 May 1981. vp.

PAT-APPL-268422.

The novel radioactive compound ^{18}F-4-fluoroantipyrine having high specific activity which can be used in nuclear medicine in diagnostic applications, prepared by the direct fluorination of antipyrine in acetic acid with radioactive fluorine at room temperature and purifying said radioactive compound by means of gel chromatography with ethyl acetate as eluent is disclosed. The non-radioactive 4-fluoroantipyrine can also be prepared by the direct fluorination of antipyrine in acetic acid with molecular fluorine at room temperature and purified by means of gel chromotography with ethyl acetate eluent.

4008 Combustion, Pyrolysis, And High-temperature Chemistry

50356 **(N—84-20551) Saturated laser fluorescence in turbulent sooting flames at high pressure.** King, G.B.; Carter, C.D.; Laurendeau, N.M. (Purdue Univ., Lafayette, IN (USA)). Apr 1984. 6p. NTIS, PC A14/MF A01.

The primary objective was to develop a quantitative, single pulse, laser-saturated fluorescence (LSF) technique for measurement of radical species concentrations in practical flames. The species of immediate interest was the hydroxyl radical. Measurements were made in both turbulent premixed diffusion flames at pressures between 1 and 20 atm. Interferences from Mie scattering were assessed by doping with particles or by controlling soot loading through variation of equivalence ratio and fuel type. The efficacy of the LSF method at high pressure was addressed by comparing fluorescence and adsorption measurements in a premixed, laminar flat flame at 1-20 atm. Signal-averaging over many laser shots is sufficient to determine the local concentration of radical species in laminar flames. However, for turbulent flames, single pulse measurements are more appropriate since a statistically significant number of laser pulses is needed to determine the probability function (PDF). PDFs can be analyzed to give true average properties and true local kinetics in turbulent, chemically reactive flows.

50357 **Photoelectron spectroscopy of 1-propyl, 1-butyl, isobutyl, neopentyl, and 2-butyl radicals: free radical precursors to high-energy carbonium ion isomers.** Schultz, J.C.; Houle, F.A.; Beauchamp, J.L. (California Inst. of Tech., Pasadena). *Journal of the American Chemical Society;* **106**: No. 14, 3917-3927(11 Jul 1984).

The first photoelectron bands of 1-propyl, 1-butyl, isobutyl, neopentyl, and 2-butyl radicals have been obtained. Adiabatic and vertical ionization potentials, respectively, are 8.15 +/- 0.02 and 8.43 +/- 0.02 eV for 1-propyl radical, 8.02 (+0.04 - 0.1) and 8.50 +/- 0.04 ev for 1-butyl radical, 7.93 (+0.03-0.1) and 8.31 +/- 0.03 eV for isobutyl radical, 7.88 +/- 0.05 and 8.25 +/- 0.03 eV for neopentyl radical, and 7.25 +/- 0.02 and 7.59 +/- 0.03 eV for 2-butyl radical. From recently determined or estimated heats of for-

mation of the radicals, heats of formation of the corresponding carbonium ions are calculated to be 210.5 +/- 1.1 kcal/mol for 1-propyl cation, 201.9 +/- 3 kcal/mol for 1-butyl cation, 197.9 +/- 3 kcal/mol for isobutyl cation, 188.8 +/- 2.3 kcal/mol for neopentyl cation, and 181.0 +/- 1.1 kcal/mol for 2-butyl cation. The energetics of ion solvation processes are assessed from a comparison of the gas-phase results to solution data where these ions are generated as nascent products of ionization processes or are proposed as reaction intermediates in isomerization reactions. With the exception of the 1-propyl radical spectrum, the spectra exhibit no resolved vibrational structure. The possible origins of a weakly resolved 540 +/- 160 cm^{-1} vibrational progression observed on the 1-propyl radical band are discussed. An analysis of these spectra, along with those of ethyl and 2-propyl radicals, reveals treads in ionization potentials that may be interpreted in terms of inductive and hyperconjugative effects of methyl substituents β to primary or secondary cation centers. 96 references, 7 figures, 2 tables.

42 ENGINEERING

4201 General Engineering

50358 **(INIS-mf—9038) Autos 82. Volume 2. Automation in engineering.** Brejcha, M. (ed.). (Skoda, Plzen (Czechoslovakia). Zavodni Pobocka Ceske Vedeckotechnicke Spolecnosti). 1982. 23p. (In Czech). (CONF-8206259—Vol.2). NTIS (US Sales Only), PC A02/MF A01. File Number DE84780617.

From Autos 82 - Automation in engineering meeting; Plzen, Czechoslovakia (15 Jun 1982).

Separate abstracts are presented for each of the papers included in the data base.

50359 **(PNL-SA—12461) Models for mixture experiments when the response depends on the total amount.** Piepel, G.F. (Florida Univ., Gainesville (USA). Dept. of Statistics; Pacific Northwest Lab., Richland, WA (USA)). Aug 1984. Contract AC06-76RL01830. 34p. (CONF-840849—7). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85000370.

From Annual meeting of the American Statistical Association (ASA); Philadelphia, PA, USA (12 Aug 1984).

The usual definition of a mixture experiment requires that the response depend only on the proportions of the mixture components and not on the total amount of the mixture. We remove that restriction and consider modified mixture models that incorporate the total amount. Models in the individual component amounts are also considered and are compared to the modified mixture models. Examples are used to illustrate the development, interpretation, and comparison of the models.

4202 Facilities And Equipment

REFER ALSO TO CITATION(S) 42020049515, 49516, 49746, 49903, 50141, 50458, 50467, 50468, 50469, 50470, 50471, 50472, 50495, 50955, 51019, 51021, 51028, 51029, 51030, 51031, 51041

50360 **(AD-A—141113/1) Superconducting electronic film structures. Annual report 1 January-31 December 1983.** Braginski, A.I.; Gavaler, J.R. (Westinghouse Research and Development Center, Pittsburgh, PA (USA)). 11 Jan 1984. 19p. NTIS, PC A02/MF A01.

Single crystal NbN films were prepared on sapphire having a (2,-1,-1,3) surface orientation. Electron diffraction and Laue data show that the NbN and sapphire orientations are related, proving epitaxial growth. A15 structure V-Si and for the first time A15 Nb-Ge films were prepared reproducibly by a reactive sputtering process. These compounds were formed at temperatures as low as 500 C with critical temperatures above 12K. Niobium films were prepared at less than 100 C with critical temperatures greater than 9K. Epitaxial quality A15 Nb-Ir single crystal substrates were prepared. A new magnetron sputtering system was implemented. Progress on the assembly and implementation of a MBE-type deposition and in situ analytical facility is reported.

50361 **(AERE-G—3002) Final report on contamination surveys at NPL.** Tuplin, T.A. (UKAEA Atomic Energy Research Establishment, Harwell. Environmental and Medical Sciences Div.). Feb 1984. 20p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703136.

The Environmental and Medical Sciences Division of Harwell was contracted to carry out detailed surveys of Building 154 at the National Physical Laboratory, Teddington. The survey used a variety of radiation detectors appropriate to the conditions found and also involved monitoring for the presence of beryllium, by means of smear (wiping) tests. The results from the beryllium survey showed that no areas exceeded accepted control limits. The results of the contamination survey indicated a few places where the derived limit was exceeded. However, averaged over the accepted surface area (1000 cm^2), and noting that the contamination was fixed, the levels were considered to present no hazard to any worker in the area nor to anyone outside the building. The environmental radiation in Room 35, the most contaminated room, was one hundredth of a millirem per hour. In only one area (Room 26) was there a radiologically significant dose rate, caused by a sealed source of cobalt-60. The accessible dose rates close to the source were around 8 millirem per hour. However, the uranium contamination should be removed to be consistent with the principle that radiation exposure should be as low as reasonably achievable.

50362 **(AERE-G—3011) Contamination surveys of plant room and roof-void in B. 154 at the National Physical Laboratory, Teddington.** Tuplin, T.A. (UKAEA Atomic Energy Research Establishment, Harwell. Environmental and Medical Sciences Div.). Feb 1984. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703137.

Surveys of the roof-void, the plant room, the precipitron room and certain ventilation extracts, of Building 154 were carried out at the National Physical Laboratory, Teddington, on 31 January 1984 to identify any areas of either radioactive or beryllium contamination. The results show that there was no significant radioactive contamination; where activity was detected it was confined to a few isolated spots, none of which exceeded the derived limit (DL). In two areas of the roof-void the gamma radiation level was greater than background, although in neither case was it radiologically significant. The first of the increased readings was found above Room 38, which contained the experimental radioactive sources identified in the earlier survey of the laboratories, and the other was traced to the radiation emitted from the luminised dial of a clock hanging above the doorway to Room 36. The results of the beryllium survey showed that in no area was the control limit exceeded.

50363 **(AERE-M—3376) Laboratory techniques for safe encapsulation of α-emitting powder samples.** Chamberlain, H.E.; Pottinger, J.S. (UKAEA Atomic Energy Research Establishment, Harwell. Chemistry Div.). Jan 1984. 9p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703140.

Plutonium oxide powder samples can be encapsulated in thin plastic film to prevent spread of contamination in counting and X-ray diffraction equipment. The film has to be thin enough to transmit X-rays and α-particles. Techniques are described for the wrapping process and the precautions necessary to keep the sample processing line free of significant contamination.

50364 **(BM-TPR—115) Electric arcing at high voltage during methane-air explosions inside explosion-proof enclosures. Technical progress report.** Scott, L.W.; Dolgos, J.G. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). Feb 1982. 12p. NTIS, PC A02/MF A01. File Number DE84901905.

The ions produced by a methane-air flame are indeed capable of triggering a sustained electrical arc across air-gap spacings that would be safe in ordinary locations where there is no methane. It was found that arcing is most likely to occur in a 9.8% methane-air mixture. The minimum arcing voltage was found to increase with the distance between the electrodes. It follows that the danger of arcing can be decreased in explosion-proof enclosures by using larger air-gap spacings between live conductors of opposite polarity

and between live conductors and earth. Figure 7 is a plot of the actual minimum arcing voltage versus air-gap spacing. However, since these experiments were conducted for design purposes, it was decided that a factor of 1.5 should be applied to the spacing obtained in figure 7, in order to provide a margin of safety. All clearance data were obtained using 12.5-mm (0.5-inch) diameter spherical brass electrodes at room temperature and atmospheric pressure, thus giving optimistic values of clearance. The required clearances for pointed electrodes are considerably greater. Pointed terminations should be avoided, and every effort should be made to employ rounded terminations with smooth surfaces. 7 figures, 1 table.

50365 **(BNL—35171) Survey of the finish characteristics of machined optical surfaces.** Church, E.L.; Takacs, P.Z. (Army Research and Development Command, Dover, NJ (USA); Brookhaven National Lab., Upton, NY (USA)). Aug 1984. Contract AC02-76CH00016. 103p. (CONF-840872—28). NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85001343.

From SPIE annual technical symposium; San Diego, CA, USA (19 Aug 1984).

This paper reports the findings of a survey of the finished characteristics of machined optical surfaces. The names, addresses, points of contact and telephone numbers of each of the nine participating suppliers are listed alphabetically. The machining parameters provided by and/or derived from information supplied by the manufacturer are summarized. These parameters include: surface material; machine feeds and speeds; tool-mark spacing (d); tool tip radius (R); and ideal RMS surface roughness computed using the expression (Comments) section includes general remarks about the sample or its measurement. For example: discoloration, scratches, graininess, excrescences, homogeneity. Several measurements were made on each sample at different positions. The present report includes data from one such measurement. For surfaces turned off-center, this position is generally at the center of the sample. For surfaces turned on-center, this position is somewhere near the edge. Data are presented in the form of two pages for each measurement, consisting of two graphs of the surface profile on one page and two graphs of the periodogram on the second page.

50366 **(CONF-831012—13) Hot Fuel Examination Facility's neutron radiography reactor.** Pruett, D.P.; Richards, W.J.; Heidel, C.C. (Argonne National Lab., Idaho Falls, ID (USA)). 1983. Contract W-31-109-ENG-38. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002147.

From International symposium on use and development of low and medium flux research reactors; Cambridge, MA, USA (17 Oct 1983).

Argonne National Laboratory-West is located near Idaho Falls, Idaho, and is operated by the University of Chicago for the United States Department of Energy in support of the Liquid Metal Fast Breeder Reactor Program, LMFBR. The Hot Fuel Examination Facility, HFEF, is one of several facilities located at the Argonne Site. HFEF comprises a large hot cell where both nondestructive and destructive examination of highly-irradiated reactor fuels are conducted in support of the LMFBR program. One of the nondestructive examination techniques utilized at HFEF is neutron radiography, which is provided by the NRAD reactor facility (a TRIGA type reactor) below the HFEF hot cell.

50367 **(HEDL—7376-Rev.1) Conceptual design report for a remotely operated cask handling system. Revision 1.** Yount, J.A.; Berger, J.D. (Hanford Engineering Development Lab., Richland, WA (USA)). Sep 1984. Contract AC06-76FF02170. 198p. (TTC—0449-Rev.1). NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE85000348.

Recent advances in remote handling utilizing commercial robotics are conceptually applied to lowering operator cumulative radiation exposure and increasing throughput during cask handling operations in nuclear shipping and receiving facilities. Revision 1 incorporates functional criteria for facility equipment, equipment technical outline specifications, and interface control drawings to assist Architect Engineers in the application of remote handling to waste shipping and receiving facilities. The document has also been updated to show some of the equipment used in proof-of-principle testing during fiscal year 1984. 10 references, 50 figures, 1 table.

50368 **(INIS-mf—8882) Experts' meeting: Maintenance '83. Maintenance and reliability.** (Deutsches Komitee Instandhaltung e.V., Duesseldorf (Germany, F.R.)). 1983. 426p. (In German). (CONF-8310287—). NTIS (US Sales Only), PC A19/MF A01. File Number DE85780005.

From Experts' meeting: Maintenance '83; Wiesbaden, F.R. Germany (10 Oct 1983).

The brochure presents, in full wording, 20 papers read at the experts' meeting "Maintenance '83" in Wiesbaden. Most of the papers discuss reliability data (acquisition, evaluation, processing) of nearly all fields of industry.

50369 **(INIS-mf—9036) Autos 82. Volume 4. Automation in engineering.** Brejcha, M. (ed.). (Skoda, Plzen (Czechoslovakia). Zavodni Pobocka Ceske Vedeckotechnicke Spolecnosti). 1982. 53p. (In Czech). (CONF-8206259—Vol.4). NTIS (US Sales Only), PC A04/MF A01. File Number DE85780006.

From Autos 82 - Automation in engineering meeting; Plzen, Czechoslovakia (15 Jun 1982).

Separate abstracts are presented for each of the papers included in the data base.

50370 **(INIS-mf—9037) Autos 82. Volume 1. Automation in engineering.** Brejcha, M. (ed.). (Skoda, Plzen (Czechoslovakia). Zavodni Pobocka Ceske Vedeckotechnicke Spolecnosti). 1982. 17p. (In Czech). (CONF-8206259—Vol.1). NTIS (US Sales Only), PC A02/MF A01. File Number DE85780007.

From Autos 82 - Automation in engineering meeting; Plzen, Czechoslovakia (15 Jun 1982).

Separate abstracts are presented for each of the papers included in the data base.

50371 **(INIS-mf—9039) Autos 82. Volume 3. Automation in engineering.** Brejcha, M. (ed.). (Skoda, Plzen (Czechoslovakia). Zavodni Pobocka Ceske Vedeckotechnicke Spolecnosti). 1982. 46p. (In Czech). (CONF-8206259—Vol.3). NTIS (US Sales Only), PC A03/MF A01. File Number DE85780003.

From Autos 82 - Automation in engineering meeting; Plzen, Czechoslovakia (15 Jun 1982).

Separate abstracts are presented for each of the papers included in the data base.

50372 **(LBL—18195) Resonant activation of a Josephson junction.** Devoret, M.H.; Martinis, J.M.; Esteve, D.; Clarke, J. (Lawrence Berkeley Lab., CA (USA)). Aug 1984. Contract AC03-76SF00098. 6p. (CONF-840842—30). NTIS, PC A02/MF A01; GPO Dep. File Number DE85000702.

From 17. international conference on low temperature physics; Karlsruhe, F.R. Germany (15 Aug 1984).

The lifetime of the zero voltage state of a current-biased Josephson junction is reduced by the application of a weak microwave perturbation at a frequency near the plasma frequency of the junction. We call this process resonant activation. The experimental data are in good agreement with numerical simulations.

50373 **(LBL—18362) dc SQUID as a tuned radiofrequency amplifier.** Hilbert, C.; Clarke, J. (Lawrence Berkeley Lab., CA (USA)). Sep 1984. Contract AC03-76SF00098. 6p. (CONF-840937—8). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000701.

From Applied superconductivity conference; San Diego, CA, USA (9 Sep 1984).

The design criteria for a tuned radiofrequency amplifier based on a dc SQUID are briefly discussed. A practical amplifier involving a planar dc SQUID with a 4-1/4-turn spiral input coil and operated at 4.2°K had a gain of 18.6 +- 0.5 db and a noise temperature of 1.7 +- 0.5°K at 93 MHz. These results are in satisfactory agreement with predicted values.

50374 (ORNL/TM—9038) **Issues in the design of a computer-aided systems and control analysis and design environment (CASCADE).** (Oak Ridge National Lab., TN (USA)). Aug 1984. Contract AC05-84OR21400. 371p. NTIS, PC A16/MF A01; 1; GPO Dep. File Number DE84017642.

Issues are identified and discussed which impact the development of computer-based aids for research and applications tasks in the systems and control area. No software development is covered in this report. The intent of the project is to examine the requirements placed on computer-based aids by the application of the software in areas related to electric energy systems. Seven issues are used to focus the analysis: a survey of relevant applications in electric energy systems, the selection of core numerical algorithms, graphics, appropriate implementation languages, software tools, the effects of future hardware on software design decisions, and coding and documentation standards. This document reports the work of a multi-disciplinary team of individuals from several organizations. This provided contributions from the areas of systems analysis and design, software engineering, computer graphics, numerical analysis, expert systems, and digital systems engineering. The results of the project are recommendations and initial work toward the development of a computer-aided systems and control analysis and design environment (CASCADE). CASCADE would base its design capabilities upon optimization methods which relieve the engineer of the necessity to make intuitive choices about the design structure. The engineer would instead provide physically meaningful design evaluation criteria.

50375 (ORNL/TM—9038, pp 23p, Part I) **Executive summary.** Birdwell, J.D. (Univ. of Tennessee, Knoxville). Aug 1984. NTIS, PC A16/MF A01. File Number TI84017642.

In Issues in the design of a computer-aided systems and control analysis and design environment (CASCADE).

The Power Systems Technology Program at the Oak Ridge National Laboratory (ORNL) has undertaken a project to develop computer-aided control system design (CACSD) software. The objective of the first phase of this project was the specification of requirements for CACSD computer software. The results of this phase are described in this document, which contains a proposed functional structure for a computer-aided systems and control analysis and design environment (CASCADE). The environment will provide computer support to engineering teams involved in control and estimation system design and analysis associated with the modeling of dynamic systems.

50376 (ORNL/TM—9038, pp 157p, Part II) **Applications of CASCADE.** Athans, M.T. (Massachusetts Inst. of Tech., Cambridge). Aug 1984. NTIS, PC A16/MF A01. File Number TI84017642.

In Issues in the design of a computer-aided systems and control analysis and design environment (CASCADE).

This report motivates the development of an integrated set of algorithms and software packages that form a Computer-Aided Systems and Control Analysis and Design Environment (CASCADE). When the CASCADE is fully developed and distributed to US industry, government, and universities, it would act as a catalyst to significantly elevate the quality of Systems and Control Engineering analyses and designs and, concurrently, vastly increase the productivity of the systems and control engineer. Although initially motivated by power systems engineering and control problems, the proposed CASCADE can equally well serve the needs of other systems engineering applications. Thus researchers and engineers in power systems, energy systems, defense systems, C^3I systems, transportation systems, manufacturing systems, ecological systems, communications systems, and socioeconomic systems would greatly welcome, and will actively use, the CASCADE. The recommended algorithmic capability of the CASCADE attempts to reflect the state of the art in numerical analysis, operations research, system theory, estimation theory, and control theory. Great emphasis is placed upon optimization algorithms for both static and dynamic systems. Further, the recommended algorithmic capability addresses both deterministic and stochastic problems and systems, linear and nonlinear. Finally, to fully meet the VLSI and VHSIC technological advances, present and projected, both continuous-time and discrete-time (digital) analysis and design capability are discussed.

50377 (ORNL/TM—9038, pp 33p, Part III) **Core numerical library.** Laub, A.J.; Heath, M.T. (Univ. of California, Santa Barbara; Oak Ridge National Lab., TN). Aug 1984. NTIS, PC A16/MF A01. File Number TI84017642.

In Issues in the design of a computer-aided systems and control analysis and design environment (CASCADE).

The principal focus of this Working Group is the selection of the algorithms and user interface routines which will be contained in the core of the Computer-Aided Systems and Control Analysis and Design Environment (CASCADE). This Group also plays a pivotal co-ordinating role between ultimate users of the CASCADE (cf. Algorithm Applications Working Group) on the one hand and the actual software interface (cf. all other Working Groups) on the other. The primary input to this Working Group comes from the Algorithm Applications Group. The main algorithm capabilities required to support the minimal requirements suggested in that report fall into three main categories: (a) general linear algebra support, (b) certain control-related algorithms (e.g., Riccati equations), and (c) certain optimization procedures.

50378 (ORNL/TM—9038, pp 36p, Part IV) **Appropriate implementation languages.** Birdwell, J.D.; Heath, M.T.; Heller, R.W.; Laub, A.J.; Rochelle, R.W. (Univ. of Tennessee, Knoxville; Oak Ridge National Lab., TN; Univ. of California, Santa Barbara). Aug 1984. NTIS, PC A16/MF A01. File Number TI84017642.

In Issues in the design of a computer-aided systems and control analysis and design environment (CASCADE).

The language working group is a subset of the committee charged with implementing the program plan for the Standards and Requirements for Computer-Aided Control System Design Software project. The language working group is charged with making recommendations of implementation language(s) for a computer-aided design package for systems engineering. To make this recommendation, criteria are defined by which the candidate languages are evaluated. The scope of this working group has expanded somewhat; the members of the group found it necessary to consider not only the proper language, but also the software environments under which the software package is to be developed, executed, and maintained. It is most likely that a standard minimal environment must be specified as the package host to maximize performance. The original charter specified that test software was to be developed and used as an aid in language selectin; however, considering the number of languages and the number of issues this working group had to address, it became apparent this was impossible within the budget and available time. Additional complications such as the lack of an Ada compiler complicated this requirement. Furthermore, test software was of marginal benefit at this stage; rather, discussions of language issues and capabilities together with illustrative code segments were considered more appropriate.

50379 (ORNL/TM—9038, pp 43p, Part V) **Graphics capabilities.** Bly, S.A. (Lawrence Livermore National Lab., CA). Aug 1984. NTIS, PC A16/MF A01. File Number TI84017642.

In Issues in the design of a computer-aided systems and control analysis and design environment (CASCADE).

This report on graphics for CACSD is intended to specify the graphics requirements for CACSD and to suggest a method for meeting those requirements. This assumes that there is some basic set of graphical capabilities that is generally useful to the computer-aided control systems community. Given some agreement on that set of capabilities, the problem then is to determine the best way to meet those needs. Questions arise regarding the possible hardware environments, the effect of graphics standards, the ability to provide portable software, the flexibility for future enhancements, and the availability of existing graphics software. In the report, current uses of graphics in control system design are considered in order to determine graphical requirements for a CACSD package. An overview of existing graphical capabilities is outlined, including display hardware capabilities, the current efforts at graphics standardization, and graphics software packages. The requirements and capabilities are used to suggest various options for including graphics in CACSD software packages. Finally, a specification for CACSD graphics software is outlined.

50380 (ORNL/TM—9038, pp 23p, Part VI) **Software tools.** Birdwell, J.D.; Herget, C.J.; Laub, A.J.; Rochelle, R.W.; Strunce, R.R. (Univ. of Tennessee, Knoxville; Lawrence Livermore National Lab., CA; Univ. of California, Santa Barbara; Charles Stark Draper Lab., Inc., Cambridge, MA). Aug 1984. NTIS, PC A16/MF A01. File Number TI84017642.

In Issues in the design of a computer-aided systems and control analysis and design environment (CASCADE).

The tools Working Group is one of the subcommittees formed to produce and implement the program plan for the Standards and Requirements for Computer-Aided Control System Design project. The primary goal of the Tools Working Group is to develop a set of software tools which will increase the productivity of the user and satisfy the user's needs. These tools are discussed in Chapter 2. Another goal is to identify tools which would be instrumented in developing, maintaining, and verifying the package and application programs. Chapter 3 describes these package tools. Tools for craftsmen are used to increase the quality of the product, decrease labor, and speed results. Software tools have many of the same attributes as those used by craftsmen in the trades. They allow the user to perform the required work effectively and efficiently. A well-integrated software tool collection is termed an environment. Osterweil suggests that an environment should be broad in scope, user friendly, tightly integrated, internally reusable, and data-base centered. Further, it is not clear that the five characteristics are consistent with each other. This leads to the conclusion that the selection and implementation of the tools collection must be done with care.

50381 (ORNL/TM—9038, pp 30p, Part VII) **Future hardware.** Heller, R.W. (Univ. of Tennessee, Knoxville). Aug 1984. NTIS, PC A16/MF A01. File Number TI84017642.

In Issues in the design of a computer-aided systems and control analysis and design environment (CASCADE).

The future hardware working group is a subset of the committee charged with implementing the program plan for the Standards and Requirements for Computer-Aided Control System Design Software project. The future hardware working group is charged with assessing the impact of probable future hardware developments in the 1980s on a computer-aided design package for systems engineering. This assessment is necessary in order that the adverse impact of hardware developments be minimized, while taking advantage of those advances which are assets. The scope of the assessment ws originally intended to cover the following areas: (1) the effect of the engineer's workbench or satellite workstation, (2) the effect of the IEEE floating point standard, (3) advanced sixteen and thirty-two bit single user computer architectures including object oriented designs, (4) special purpose hardware such as array and vector processors, and (5) distributed computing environments made possible with local area networks and personal workstations. Each of these is defined briefly. Following the definitions a brief overview of the effects each will have on software is discussed, and a software design strategy proposed. The remaining sections discuss in greater detail each of these advancements, analyzing the effects independently of the other areas.

50382 **(UCRL—91531) Power of deterministic thinking in machine tool accuracy.** Bryan, J.B. (Lawrence Livermore National Lab., CA (USA)). Sep 1984. Contract W-7405-ENG-48. 16p. (CONF-841196—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001751.

From 1. international machine tool engineers conference; Tokyo, Japan (7 Nov 1984).

Philosophy is an important factor in precision engineering in general and the upgrading of machine tool accuracy in particular. Our philosophy has evolved from the history of the field, our own experience and the advice of colleagues. The main elements of this philosophy are the importance of patience, continuity of effort, good measuring equipment, good temperature control, carefully designed tests, and belief in the idea that machine tools obey cause and effect relationships that are within our ability to understand and control and that there is nothing random or probabilistic about their behavior.

50383 **Input impedance of an amplifier based on a dc superconducting quantum interference device.** Hilbert, C.; Clarke, J. (Department of Physics, University of California, Berkeley, California 94720 and Materials and Molecular Research Division, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Applied Physics Letters;* **45**: No. 7, 799-801(1 Oct 1984). Contract AC03-76SF00098.

The measured input impedance of an amplifier involving a coil tightly coupled to a dc superconducting quantum interference device (SQUID) is found to depend on the current and flux biases of the SQUID. Variations in the input inductance arise from the reflected dynamic inductance of the SQUID, and are in reasonable agreement with the predictions of an analog simulator. Variations in the input resistance, on the other hand, arise from feedback between the output of the SQUID and the input circuit, and are in approximate agreement with the predictions of a simple model.

50384 **Self-contained exothermic applicator and process.** Koehmstedt, P.L. (to Battelle Memorial Institute). US Patent 4,455,186. 19 Jun 1984. Filed date 26 Sep 1983. vp.

PAT-APPL-535580.

An adhesive resin application system which requires no external heating apparatus, and which is operative in the absence of a reactive atmosphere, is disclosed. The system provides its own heat by employing an adhesive material containing reactants which react exothermally when electrically ignited. After ignition of the reactants, sufficient heat energy is liberated by the exothermic reaction either to plasticize a thermoplastic resin or to cure a thermosetting resin and thereby bond together two closely spaced objects.

50385 **Laminated grid and web magnetic cores.** Sefko, J.; Pavlik, N.M. (to Dept. of Energy). US Patent 4,447,795. 8 May 1984. Filed date 5 May 1981. vp.

PAT-APPL-260635.

A laminated magnetic core characterized by an electromagnetic core having core legs which comprise elongated apertures and edge notches disposed transversely to the longitudinal axis of the legs, such as high reluctance cores with linear magnetization characteristics for high voltage shunt reactors. In one embodiment the apertures include compact bodies of microlaminations for more flexibility and control in adjusting permeability and/or core reluctance.

50386 **Effect of Ta additions upon in situ prepared Nb_3Sn-Cu superconducting wire.** Sue, J.J.; Finnemore, D.K.; Gibson, E.D.; Ostenson, J.E.; Verhoeven, J.D. (Ames Laboratory). *Metallurgical Transactions, [Section] A: Physical Metallurgy and Materials Science;* **15A**: No. 2, 283-286(Feb 1984).

The effect of Ta additions on the critical currents, J /SUB c/ , and upper critical fields, H /SUB c2/ , been examined. The Ta segregates to the Nb dendrites and causes no observable change in filament morphology. Both high field values increase to a maximum at 10 wt pct Ta in the Nb-Ta phase and drop for higher Ta contents. Improvement in J /SUB c/ in the 12 to 16 T range is small. The J /SUB c/ values of in situ wires are equivalent to bronze processed wires up to 12T but above that value they become lower.

50387 **Coupled nonlinear oscillators.** Chandra, J.; Scott, A.C. Amsterdam, Netherlands; North-Holland Publishing Company (1983). 129p.

Topics discussed include transitions in weakly coupled nonlinear oscillators, singularly perturbed delay-differential equations, and chaos in simple laser systems. Papers are presented on truncated Navier-Stokes equations in a two-dimensional torus, on frequency locking in Josephson point contacts, and on soliton excitations in Josephson tunnel junctions. Attention is also given to the nonlinear coupling of radiation pulses to absorbing anharmonic molecular media, to aspects of interrupted coarse-graining in stimulated excitation, and to a statistical analysis of long-term dynamic irregularity in an exactly soluble quantum mechanical model.

4203 Lasers

50388 **(AD-A—140984/6) Tunable optical sources. Final report 20 February 1981-19 February 1984.** Byer, R.L. (Stanford Univ., CA (USA). Edward L. Ginzton Lab.). 19 Apr 1984. 15p. (GL—3715). NTIS, PC A02/MF A01.

The objective of this study has been to advance the understanding and state-of-the-art of tunable coherent sources. The main areas of investigation have been the development of neodymium-doped-glass slab lasers, and the generation of tunable radiation by nonlinear optical conversion. This research is motivated by a number of applications including X-ray generation in laser produced plasmas for high resolution imaging and lithography, and the generation of tunable coherent radiation for remote sensing of atmospheric constituants and conditions.

50389 **(AD-A—141032/3) Infrared nonlinear processes in semiconductors. Final technical report 1 October 1979-30 November 1983.** Wolff, P.A.; Aggarwal, R.L.; Jagannath, C.; Yuen, S.Y.; Becla, P. (Massachusetts Inst. of Tech., Cambridge (USA)). 15 Feb 1984. 17p. NTIS, PC A02/MF A01.

The primary purpose of this program was to use nonlinear techniques to study electron dynamics and kinetics in semiconductors. Possible applications of nonlinear interactions were also considered. These investigations have combined theory and experiment. The statement of work for the contract included the following tasks: (A) Study impurity dynamics and electron delocalization in Ge and Si; (B) Generate infrared radiation via coherent excitation of collective modes; (C) Observe and Study magnetoacoustic waves; (D) Stimulate plasmon emission in (Hg, Cd)Te; (E) Study spin dynamics and use spins to generate far infrared radiation in (Hg, Cd)Te; (F) Study valley-transfer processes; (G) Characterize (Hg, Cd)Te with optical techniques; and (H) Study semiconductors with field-tunable gap.

50390 **(AD-A—141195/8) Uniform magnetic-field-induced free-electron laser in a waveguide.** Soln, J. (Harry Diamond Labs., Adelphi, MD (USA)). Apr 1984. 13p. (HDL-TR—2041). NTIS, PC A02/MF A01.

We discuss how a uniform focusing magnetic field can affect the performance of a microwave source such as a backward-wave oscillator. It is argued that the uniform magnetic field can cause the existence of a free-electron laser within the waveguide; the Doppler up and/or down-shifted cyclotron radiation can undergo amplification (or absorption) due to interaction of electrons (in helical orbits) with electromagnetic radiation.

50391 **(AD-A—141203/0) Study of avalanche discharge lasers. Final technical report 1 July 1975-30 September 1983.** Lin, S.C. (California Univ., San Diego, La Jolla (USA). Inst. of Pure and Applied Physical Sciences). 30 Sep 1983. 109p. NTIS, PC A06/MF A01.

Basic research carried out at the University of California, San Diego, on the study of avalanche discharge lasers is summarized. This research has resulted in many important scientific discoveries and generated much basic data which are of great value in the engineering development of high-power, short-wavelength gas lasers. The most noteworthy of these is our discovery that X-ray is far superior to both ultraviolet light and electron beams as a preionization source for homogeneous initiation of very large volume, pulsed avalanche discharges at high gas pressures. Another important discovery is that such pulsed discharges can be stably sustained at high current densities over relatively long periods of time using suitable pulse forming networks. However, in the case of the rare gas halogen excimers, the laser pulse duration is often kinetics-limited.

50392 **(AD-A—141234/5) Locking of diode gain modules using optical conjugation techniques. Final report 1 August 1982-30 September 1983.** Lam, J.F.; Rockwell, D.A. (Hughes Research Labs., Malibu, CA (USA). Optical Physics Dept.). Mar 1984. 86p. NTIS, PC A05/MF A01.

This report reviews results of a study program to investigate technical issues relating to the coupling of multiple diode lasers using a phase conjugate resonator. We present calculations showing the effects on the far-field intensity distribution of either systematic or random phase differences between adjacent gain elements; these results dramatically illustrate the beneficial impact of exact phase locking. The use of phase conjugation to phase-lock the individual emitters is suggested, and computer calculations showing the beneficial effects on the far-field intensity distribution are reviewed. The normal modes of a multiple-element diode chip are are derived; this information allows one to determine phase relationships characteristics of each mode. These relationships can be used to identify approaches that might be employed to favor one particular mode in a practical device.

50393 **(AD-A—142536/2) CO_2 gamma 3 fundamental band 4.5 micrometers laser potential. Final report 2 May 1983-26 March 1984.** Rich, J.W.; Bergman, R.C. (Calspan Advanced Technology Center, Buffalo, NY (USA)). Mar 1984. 38p. (CALSPAN—7176-A-1). NTIS, PC A03/MF A01.

This report presents results of an experimental program to explore the lasing potential of the CO_2 (0,0,V3) = CO_2 (0,0,V3-1) a symmetric stretch bands in a cooled electrical glow discharge. The CO_2 (0,0,V3) level populations were measured by infrared emission spectroscopy from V3 0= 1 to V3 = approximately 10. The influence of flow velocity, discharge current density, and wall temperature on the populations was measured. It was found that these states do enter a vibration-to-vibration pumped partial population inversion, which is enhanced at lower temperatures. However, states above V3 = approximately 10 do not appear pumped, and the inversion was insufficient to achieve laser oscillation in the apparatus used. Alternate experimental configurations which may achieve lasing on these bands are suggested.

50394 **(DOE/ER/10990—T2) Imploding plasma x-ray laser research. Draft final report.** Wong, S.; Koppel, L.; Burr, L.; Rodenburg, R.; Fortner, R.; Stewart, R.; Dietrich, D.; Egan, P.; Young, B.; Dukart, R. (Physics International Co., San Leandro, CA (USA)). Sep 1984. Contract AC03-81ER10990. 40p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85000057.

The population inversion mechanisms and gain estimates for the Ne-like Kr x-ray laser scheme are discussed. An experimental configuration has been developed which produces stable plasmas with conditions close to the optimum for lasing. By imploding a coaxial argon plasma on an inner krypton plasma (the puff-on-puff configuration), a quiescent krypton center plasma was produced with an electron temperature of about 600 eV and an electron density of about 10^{21} cm^{-3}. The center plasma was stable and linear, with little evidence of kink instabilities. Nozzle development work was also performed. X-ray measurements of electron temperature and density as well as XUV linewidths are presented. (LEW)

50395 **(LA-UR—84-1831) Alumina/silica multilayer coatings for excimer lasers.** Foltyn, S.R.; Jolin, L.J. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 7p. (CONF-8311146—6). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84013897.

From Symposium on optical materials for high power lasers; Boulder, CO, USA (14 Nov 1983).

The coating parameter that most strongly influences optical damage resistance is the choice of materials used to produce a component. During the course of testing of hundreds of ultraviolet reflectors involving 12 different material combinations, multilayer stacks of Al_2O_3/SiO_2 have demonstrated a superior ability to resist laser-induced damage. Further, damage thresholds for these coatings are at least twice as high as for reflectors composed of other materials. In particular, thresholds of 6 J/cm^2 at 248 nm (15 ns) and 12 J/cm^2 at 351 nm (12 ns) have been measured. Comparative results are presented for a variety of materials at both wavelengths as are preliminary results for alumina-based antireflective coatings.

50396 **Variable-output coupler for laser cavities with totally reflecting mirrors.** Holl, H.B.; Barr, Th.A. Jr.; Roberts, Th.G. (to Secretary of the Army). US Patent 4,458,350. 3 Jul 1984. Filed date 26 Sep 1979. vp.

PAT-APPL-78996.

An output coupler, for laser cavities with totally reflecting mirrors, having a beam splitter and a mirror mounted so that the direction of the output beam of the laser is invariant to changes in the output coupling coefficients. The percentage of the laser's energy which is coupled out into an external beam can be continuously varied or varied to obtain the optimum output coupling coefficient and then left set on this value. This device can also be used as a variable beam splitter with an invariant direction for the reflected beam when used external to the cavity of any laser.

50397 **Fourier-transform ring laser.** Sklar, E. (Los Alamos National Lab., NM). *Journal of the Optical Society of America A: Optics and Image Science;* 1: 537-540(May 1984).

A Fourier-transform ring laser has been designed and toleranced to produce a good-quality beam from a solid-state laser. Extremely high volumetric utilization of the gain distribution is accomplished by injecting a super-Gaussian-shaped beam profile of uniform phase and nearly uniform intensity into the ring resonator. This beam fills most of the rod and is reproduced at the rod center in both intensity and phase by an exact Fourier-transform relay lens scheme. The laser is shown to be most stable when the diameter of the super-Gaussian beam is equal to diameter of the eigenmode for the optical system. It is shown to be most reliable when the relay system has a magnification such that the beam expands from its initial eigenmode size to fill the rod on its final pass. 7 references.

4204 Heat Transfer And Fluid Flow

REFER ALSO TO CITATION(S) 42040049908

50398 **(DOE/ER/03077—223) Front tracking for gas dynamics.** Chern, I.L.; Glimm, J.; McBryan, O.; Plohr, B.; Yaniv, S. (New York Univ., NY (USA). Courant Mathematics and Computing Lab.). May 1984. Contract AC02-76ER03077. 53p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85000571.

Front tracking is an adaptive computational method in which a lower dimensional moving grid is fitted to and follows the dynamical evolution of distinguished waves in a fluid flow. The method takes advantage of known analytic solutions, derived from the Rankine-Hugoniot relations, for idealized discontinuities. In this paper the method is applied to the Euler equations describing compressible gas dynamics. The main thrust here is validation of the front tracking method: we present results on a series of test problems for which comparison answers can be obtained by independent methods.

50399 **(DOE/ER/13164—T1) Convection heat transfer in the critical region of fluid mixtures. Progress report.** Marschall, E. (California Univ., Santa Barbara (USA). Dept. of Mechanical and Environmental Engineering). Sep 1984. Contract AT03-84ER13164. 14p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002118.

An experimental apparatus for measuring heat transfer rates and heat transfer coefficients in the critical region of pure fluids and fluid mixtures has been constructed and testing of the apparatus has begun. For the remainder of this year, more tests will be carried out in order to ensure precise measurements of the heat transfer rates and related parameters. The actual experiments are scheduled to begin in January.

50400 **(FEI—1489) Flow in a channel with fluid bleed through lateral walls.** Marina, L.V.; Nomofilov, E.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1983. 15p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703146.

Numerical studies of hydrodynamical characteristics of an incompressible laminor flow in a channel between plates with uniform fluid bleed through lateral walls are carried out. Solutions are determined for the Reynolds numbers at the inlet from 10 to 10^4. At RQ–150 and the ratio of channel length and width equal to 10 the initial cross section is deformed along its length independent of the velocity profile. Velocity profile deformation at its parabolic distribution on the initial part occurs under the effect of fluid bleed. When a shock profile is preset at the input the effect of fluid friction against the wall is added. Due to this fact the difference in the velocity profiles is observed at ratios of pitch along the length and length less than 0.74; further the velocity profile does not depend on the initial distribution. The effect of the channel length on velocity profile deformation is studied at Re=150 and the length exceeding the channel width 10 to 40 times. It is found that in a channel with a permeable wall (under condition of complete fluid bleed and even when there is no solid wall at the output) restricted zones of backward flow can appear. The zone size and traffic density inside increase with the Resub(in) number and channel length. It is shown that viscous friction in the channel with permeable walls has a considerable effect on velocity profile formation with the channel height. Numerical solution of the algorithm of boundary layer type equations written in the "current function-vorticity" variables is simpler and its convergence is higher than that obtained using ordinary boundary layer equations since there is no need in checking mass conservation in every calculated cross section. The algorithm is realized as a program for the BESM-6 computer written in FORTRAN-4.

50401 **(KFK—3667) Experiment for triggered fragmentation with a molten copper-drop in water.** Ando, M. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Schneller Brueter; Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Maschinenbau). Dec 1983. 149p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE84751522.

Experiments are performed to investigate the fragmention mechanism. Main features of the experiment are the use of a high-speed movie camera with the maximum recording frequency of 100 000 frames per second which is about 20 times the recording frequency of conventional highspeed movie cameras and the application of an external trigger to induce the fragmentation. The material combination copper/water is employed and experiments are carried out in the normal atmosphere and in two reducing atmospheres. The highspeed movie camera employed enabled a detailed phenomenological observation of the fragmentation process which in this manner had not been performed prior to this experiment due to the extremely short fragmentation time (1 ms). Two types of fragmentation, delayed and prompt fragmentation, were identified. The occurance of the delayed and prompt fragmentation, respectively, is governed by two parameters, the temperature of the hot melt and the magnitude of the triggerpuls. A threshold is identified which can be described as a function of the two parameters mentioned above. These observations can be explained with the change of the surface tension of the hot melt which is influenced by the atmosphere in which experiments are carried out. Based on these facts a phenomenological model of the fragmentation mechanism is proposed.

50402 **(NP—4770475) Evaporation of R11/R113 mixtures at a horizontal cylinder in crossflow.** Fink, J. (Technische Univ. Clausthal, Clausthal-Zellerfeld (Germany, F.R.). Fakultaet fuer Bergbau, Huettenwesen und Maschinenwesen). 26 Nov 1982. 209p. (In German). NTIS (US Sales Only), PC A10/MF A01. File Number DE84770475.

The heat transfer by boiling of R11/R113 mixtures at an electrically heated horizontal cylinder with an outer diameter of 25 mm in cross-flow has been investigated experimentally under variation of the flow velocity, the subcooling and the composition of the fluid. With decreasing heat flux density, the regions of fully developed nucleate boiling, transition, and one-phase forced convection have been passed through. In the regime of fully developed nucleate boiling, the flow velocity as well as the subcooling have no significant influence on the heat transfer as well for pure substances as for binary mixtures. The reduction of the heat transfer which could be stated for mixtures could be represented as a linear function of the concentration difference between vapor and liquid in equilibrium. In the transition regime, the heat transfer coefficients depend also on the flow velocity and on the subcooling. From existing equations for pure liquids under forced flow conditions and for binary mixtures under pool conditions, an equation has been derived which represents the measured data with sufficient accuracy.

50403 **(NP—4770515) Development of self-adaptive difference method for the solution of three-dimensional laminar incompressible boundary layer equations with arctrolled error.** Schoenauer, W.; Glotz, G.; Daeubler, H.G.; Raith, K.; Haefele, K. (Karlsruhe Univ. (TH) (Germany, F.R.). Rechenzentrum). Nov 1983. 282p. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE84770515.

The solution of the 3-D incompressible laminar boundary layer equations in streamline-potentialline coordinates is presented. The information about the 3-D body configuration and the inviscid velocity potential is assumed to be given by points. Then the inviscid streamlines are computed which now contain, again by points, the information about the body. The solution method for the boundary layer equations is a difference method with self-adapted step size and order in the streamline direction and with given grid in the potentialline direction (which is "superposed" to the computed grid) with self-adapted order. In the normal direction the grid and the order are optimized in the stagnation point and then remain fixed. The dividing streamlines, in which many streamlines coincide, cause a disagreable singularity of the boundary layer equations. Besides the solution method, also the resulting computer program is discussed in detail.

50404 **(NP—4770517) Heat transfer in a closed thermosyphon tube filled with near critical fluid.** Gross, U. (Stuttgart Univ. (Germany, F.R.). Fakultaet 5 - Energietechnik). 18 Jul 1983. 133p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE84770517.

The heat transfer in the heating and in the cooling zone of a closed thermosyphon tube has been studied experimentally. Fluid pressure (0.8<p/psub(crit)<1.1), heat flow rate (175W<=Q<=1975W), and inclination angle (0°<=phi<=60°) of the tube were varied. As working fluid, refrigerant R115 was used. The quantity of fluid was taken so that the critical specific volume is obtained. In subcritical states there exists boiling in the heating zone and condensation in the cooling zone. Depending on pressure there are three regimes of boiling: pure nucleate boiling, nucleate boiling in a transition region, and film boiling. Small tilt, large heat flow rates, and high pressures are best conditions for a large heat transfer coefficient; these, however, also promote transition to film boiling. In the thermosyphon there exists laminar and turbulent film condensation respectively. Largest heat transfer coefficients are obtained in laminar film conditions at small heat flow rates, with inclination angles between phi=20° and phi=40°, and high pressures, caused by a growing disturbance of smooth film surface with increasing pressure. In the supercritical state heat is transferred by single phase natural convection. Heat transfer coefficients are largest near the critical point especially for low heat flow rates, and large inclination angles remaining smaller than subcritical ones.

50405 **(NP—4770529) Model investigations about flow in industrial halls with heat sources.** Wagner, R. (Technische Univ. Clausthal, Clausthal-Zellerfeld (Germany, F.R.). Fakultaet fuer Bergbau, Huettenwesen und Maschinenwesen). 19 Aug 1982. 141p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE84770529.

For the ventilation and aeration of workshop halls with large heat and dust sources, knowledge of parameters influencing the air flow is required. The temperature and velocity field generated in halls is determined not only by the geometry but also by forced and free convection. Predictive calculations of the total flow within a hall can only be done using complex calculation methods, the experimental confirmation of the results from calculations being essential. Within this study, tests are carried out using geometrically scaled down models of workshop halls, where the flow fields are simulated. For the conception of these models, first the non-dimensional coefficients relevant for the flow field need to be derived. The paper shows that tests on scaled down models are possible only if free buoyancy flow from heat sources is replaced in the model by a forced flow.

50406 **Direct-contact closed-loop heat exchanger.** Berry, G.F.; Minkov, V.; Petrick, M. (to Dept. of Energy). US Patent 4,458,747. 10 Jul 1984. Filed date 2 Nov 1981. vp. PAT-APPL-317706.

A high temperature heat exchanger with a closed loop and a heat transfer liquid within the loop, the closed loop having a first horizontal channel with inlet and outlet means for providing direct contact of a first fluid at a first temperature with the heat transfer liquid, a second horizontal channel with inlet and outlet means for providing direct contact of a second fluid at a second temperature with the heat transfer liquid, and means for circulating the heat transfer liquid.

50407 **Hydrodynamic stability of inverted annular flow in an adiabatic simulation.** De Jarlais, G.; Ishii, M.; Linehan, J. (Argonne National Lab., IL). *HTD [Publication] (American Society of Mechanical Engineers);* **23**: 75-83([1984]).

Inverted annular flow was simulated adiabatically with turbulent water jets, issuing downward from large aspect ratio nozzle, enclosed in gas annuli. Velocities, diameters, and gas species were varied, and core jet length, shape, break-up mode, and dispersed core droplet sizes were recorded at approximately 750 data points. Inverted annular flow destabilization lead to inverted slug flow at low relative velocities, and to dispersed droplet flow at high relative velocities. For both of these transitions from inverted annular flow, core break-up length correlations were developed by extending work on free liquid jets to include this coaxial, jet disintegration phenomenon. The results show length dependence upon D/sub J/, Re/sub J/, α and We/sub G, rel/. Correlations for core shape, break-up mechanisms and dispersed core droplet size were also developed, by extending the results of free jet stability, roll wave entrainment, and churn turbulent droplet stability studies.

4205 Materials Testing

REFER ALSO TO CITATION(S) 42050049486, 49487, 49802, 49807, 49808, 49809, 49814, 50111, 50198

50408 **(CONF-840738—6) Experimental verification of eddy-current flaw theory.** Dodd, C.V.; Cox, C.D.; Deeds, W.E. (Oak Ridge National Lab., TN (USA); Oak Ridge Associated Universities, Inc., TN (USA); Tennessee Univ., Knoxville (USA)). 1984. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001288.

From Progress in quantitative NDE; San Diego, CA, USA (8 Jul 1984).

Carefully machined flaw samples in plates and tubes were examined with eddy-current coils of accurately known dimensions. Both near- and far-side flaws were measured using absolute and differential coil modes. The experimental data were compared with computer calculations based on the flaw theory of Burrows and the analytical solutions of Dodd and Deeds. The experimental and theoretical data are in good agreement whenever the flaw size is small compared to the other significant dimensions, but large enough to give a reasonable signal-to-noise ratio for the measuring instrument. The experimental and analytical readings are also used to check the flaw inversion theory.

50409 **(CONF-8411104—1) Direct comparison of unloading compliance and potential drop techniques in J-integral testing.** McGowan, J.J.; Nanstad, R.K. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001550.

From Fall conference of the Society for Experimental Mechanics; Milwaukee, WI, USA (4 Nov 1984).

Single-specimen J-integral testing is performed commonly with the unloading compliance technique. Use of modern instrumentation techniques and powerful desktop computers have made this technique a standard. However, this testing technique is slow and tedious, with the loading rate fixed at a slow quasi-static rate. For these reasons the dc potential drop technique was investigated for crack length measurement during a J-integral test. For direct comparison, both unloading compliance and potential drop were used simultaneously during a J-integral test. The results showed good agreement between the techniques. However, the potential drop technique showed an offset in crack length due to plastic

blunting processes. Taking this offset into account, J/sub Ic/ values calculated by both techniques compared well.

50410 **(EGG-M—20984) Modeling of real UT transducer field/flaw interactions.** Barna, B.A. (EG and G Idaho, Inc., Idaho Falls (USA)). 1984. Contract AC07-76ID01570. 9p. (CONF-840738—7). NTIS, PC A02/MF A01; GPO Dep. File Number DE85000341.

From Progress in quantitative NDE; San Diego, CA, USA (8 Jul 1984).

The field/flaw interaction is modelled with an integration of the portion of the transducer field that is reflected by the flaw. Essentially, this is a short wavelength approximation in which the scattering due to the flaw is treated as a specular reflection back to the transducer. The system investigated was a vertical surface-breaking crack being insonified with a refracted shear wave in an immersion tank. The model allows for the shape of the acoustic pulse wavefronts as they impinge upon the refracted surface of the crack sample. The model operates in the Fourier domain and assumes that a discrete Fourier transform is the input spectrum for the given transducer. The spectrum is then modified at each frequency by calculating what angular portion of the field is reflected by the flaw and what the reflection and transmission coefficients are for the angle of incidence on the surface of refraction. A comparison of the model prediction with experimental measurements is made. (LEW)

50411 (INIS-mf—8881, pp vp) **Solidification and segregations in heavy ingots.** Maidorn, C. (Kloeckner-Werke A.G., Osnabrueck (Germany, F.R.)); Blind, D. (Stuttgart Univ. (Germany, F.R.). Staatliche Materialpruefungsanstalt). 1983. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84780610. (CONF-8310224—).

From MPA seminar on safety of light water reactor pressure vessels; Stuttgart, F.R. Germany (13 Oct 1983).

Segregations are unavoidable in forged blocks, but their thickness and effect can be influenced. Local segregations are quite tolerable if the surrounding matrix is tough and the processing, e.g. welding, is done correctly. The methods of non-destructive testing now available make it possible to find and assess cracks in segregation areas. The safety assessment of the segregation can be done by conventional means.

50412 (INIS-mf—9036, pp 786-795) **Vibroacoustic diagnostic system.** Prokop, K. (Energoinvest, Dukovany (Czechoslovakia). Zavod Jaderna Elektrarna); Hulin, J.; Karmasin, K. (Jaderna Elektrarna, Dukovany (Czechoslovakia)). 1982. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number TI85780006. (CONF-8206259—Vol.4).

From Autos 82 - Automation in engineering meeting; Plzen, Czechoslovakia (15 Jun 1982).

The basic configuration is given of a vibroacoustic diagnostic system, its block diagram and the general description of operation. The operation is described in detail of the system when the warning or alarm level of vibrations is exceeded. The system operates online and allows the analysis of the vibration trend parameters, transfer functions, correlation, probability distribution of amplitude and other analyses for studying the state of equipment and predicting its future state.

50413 (INIS-mf—9052, pp 36) **Radioisotopic methods in metal founding.** Rajchev, Kh.; Boyadzhiev, L.; Peneva, Ts. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). 1983. (In Bulgarian). NTIS (US Sales Only), PC A99/MF A01. File Number TI84780548. (CONF-8309253—Absts.).

From 1. national congress of the physicists in Bulgaria; Sofia, Bulgaria (28 Sep 1983).

Published in summary form only.

50414 **(LA—10215-MS) Metallographic grinding efficiency.** Johnson, K.A. (Los Alamos National Lab., NM (USA)). Sep 1984. Contract W-7405-ENG-36. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001520.

The efficiency of material removal from metallographic mounts is reported. Grinding papers, lubrication rate, lubricant's speed, and hold-down weight are compared and evaluated. Data are presented that indicate that the application of several principles can lead to significantly increased grinding rate efficiency.

50415 **(SCL-CR—67-191) Designing for fatigue with random vibration excitation.** Brown, G.W.; Ikegami, R. (California Univ., Berkeley (USA). Coll. of Engineering). Jun 1968. Contract AC04-76DP00789. 31p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85001758.

An experimental program was conducted to determine the correlation between fatigue life values obtained by sinusoidal fatigue tests and those obtained from narrow band random fatigue tests. The fatigue tests were performed on two commonly used aluminum alloys, 2024-T3 and 6061-T6. Specimens made from these two materials were subjected to either constant amplitude sinusoidal or narrow band random fatigue loadings. Standard tensile tests were made on these two materials in order to obtain the true stress-strain diagrams to failure.

50416 **(Y/DW—474) Ultrasonic analysis of spherical composite test specimens.** Brosey, W.D. (Oak Ridge Y-12 Plant, TN (USA)). 22 Aug 1984. Contract AC05-84OS21400. 31p. (CONF-8409132—1). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85001591.

From International symposium composites on materials and engineering; Newark, DE, USA (24 Sep 1984).

Filament wound spherical test specimens have been examined ultrasonically as part of a program to determine the effectiveness of various nondestructive evaluation techniques for analysis of mechanical characteristics of a composite with enclosed geometry. The Kevlar-epoxy composite specimens contained simulated defect conditions which were located, and the extent of damage determined, using ultrasonic analysis. Effects of transducer frequency and signal parameters have been examined to determine optimum conditions for flaw detection. The data were displayed in rectangular and axonometric projection.

50417 **(Y/DW—481) Use of the analytic signal in ultrasonic imaging.** Bell, Z.W. (Oak Ridge Y-12 Plant, TN (USA)). 24 Aug 1984. Contract AC05-84OS21400. 8p. (CONF-840738—5). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016843.

From Progress in quantitative NDE; San Diego, CA, USA (8 Jul 1984).

A software implementation and a hardware implementation of the analytic signal, in which a single sideband signal is generated. The reconstruction algorithm and the accuracy of reconstruction are discussed. Two problem areas are identified: depth resolution and the merging of images from several transducers. (LEW)

50418 **(Y/DW—519) Ultrasonic girth weld evaluation for aluminum substrate of spherical Kevlar-epoxy test specimens.** Brosey, W.D.; Dews, T.W. (Oak Ridge Y-12 Plant, TN (USA)). 28 Aug 1984. Contract AC05-84OS21400. 18p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001592.

An ultrasonic weld inspection has been developed for the girth weld of the aluminum substrate for a Kevlar-epoxy filament wound test specimen. The filament wound spheres are test coupons in a study to evaluate NDE techniques on a composite material with enclosed geometry. The girth weld of the aluminum substrate has been examined to ensure the weld is not a weak point in the coupon in which failure will initiate. Analog and B-scan data are combined to determine the presence of lack of penetration, suckback, protrusion, or porosity in the weld. The data are calibrated with a standard and then plotted as analog, B-scan, or color contour data as a function of angular position around the weld.

4206 Safety Engineering

50419 (MLM—3180(OP)) Explosive safety criteria at a Department of Energy contractor facility. Krach, F. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). Aug 1984. Contract AC04-76DP00053. 13p. (CONF-840896—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016938.

From DOE hazard classification for insensitive high explosives conference; Houston, TX, USA (28 Aug 1984).

Monsanto Research Corporation (MRC) operates the Mound facility in Miamisburg, Ohio, for the Department of Energy. Small explosive components are manufactured at MRC, and stringent explosive safety criteria have been developed for their manufacturing. The goals of these standards are to reduce employee injuries and eliminate fenceline impacts resulting from accidental detonations. This paper will describe the manner in which these criteria were developed and what DOD standards were incorporated into MRC's own design criteria. These design requirements are applicable to all new construction at MRC. An example of the development of the design of a Component Test Facility will be presented to illustrate the application of the criteria.

4208 Electronic Circuits And Devices

REFER ALSO TO CITATION(S) 42080050146, 50186, 50227, 50235, 50236, 50238

50420 (CONF-840570—14) Amorphous materials and recrystallization. Lucovsky, G.; Narayan, J. (Oak Ridge National Lab., TN (USA); North Carolina State Univ., Raleigh (USA). Dept. of Physics). May 1984. Contract AC05-84OR21400. 16p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001873.

From Materials for future energy systems conference; Washington, DC, USA (1 May 1984).

This paper has dealt with two materials science topics relevant to the utilization of semiconductors in energy systems. The first part of the paper has focused on the local chemical bonding of alloy atoms in a-Si and the second on the rapid recrystallization of ion-implanted and damaged semiconductor layers. Rapid crystallization methods based upon pulsed laser irradiation provide more efficient removal of ion implantation damage than conventional thermal annealing techniques. A complete electrical activation dopants and superior p-n junction properties are obtained by pulsed beam processing. The dopant concentrations far exceeding the equilibrium solubility limits can be obtained, which may lead to novel advanced semiconductor devices. An example of application of pulsed beam processing in the fabrication of low-cost, high-efficiency solar cells is illustrated. The information provided in this paper will be useful and helpful to scientists and engineers who are primarily concerned with the fabrication, evaluation, and optimization of devices.

50421 (N—84-21994) Polymer thick-film conductors and dielectrics for membrane switches and flexible circuitry. Nazarenko, N. (Du Pont de Nemours (E.I.) and Co., Wilmington, DE (USA)). Nov 1983. 21p. NTIS, PC A18/MF A01.

The fabrication and operation of membrane switches are discussed. The membrane switch functions as a normally open, momentary contact, low-voltage pressure-sensitive device. Its design is a three-layer sandwich usually constructed of polyester film. Conductive patterns are deposited onto the inner side of top and bottom sheets by silk screening. The center spacer is then placed between the two circuit layers to form a sandwich, generally held together by an adhesive. When pressure is applied to the top layer, it flexes through the punched openings of the spacer to establish electrical contact between conductive pads of the upper and lower sheets, momentarily closing the circuit. Upon release of force the top sheet springs back to its normal open position. The membrane touch switch is being used in a rapidly expanding range of applications, including instrumentation, appliances, electronic games and keyboards. Its board acceptance results from its low cost, durability, ease of manufacture, cosmetic appeal and design flexibility. The principal electronic components in the membrane switch are the conductor and dielectric.

50422 (N—84-21997) Dry etching of metallization. Bollinger, D. (Vesco Instruments, Plainview, NY (USA)). Nov 1983. 16p. NTIS, PC A18/MF A01.

The production dry etch processes are reviewed from the perspective of microelectronic fabrication applications. The major dry etch processes used in the fabrication of microelectronic devices can be divided into two categories - plasma processes in which samples are directly exposed to an electrical discharge, and ion beam processes in which samples are etched by a beam of ions extracted from a discharge. The plasma etch processes can be distinguished by the degree to which ion bombardment contributes to the etch process. This, in turn is related to capability for anisotropic etching. Reactive Ion Etching (RIE) and Ion Beam Etching are of most interest for etching of thin film metals. RIE is generally considered the best process for large volume, anisotropic aluminum etching.

50423 (N—84-22002) NASA flight electronics environmental stress screening survey. Marian, E.J. (Jet Propulsion Lab., Pasadena, CA (USA)). Dec 1983. 40p. (NASA-CR—173472; JPL-PUB—83-76). NTIS, PC A03/MF A01.

Data compiled by the Institute of Environmental Sciences were used to establish guidelines for identifying defective, abnormal, or marginal parts as well as manufacturing defects. These data are augmented with other available sources of similar information in conjunction with NASA centers data and presented in a form that may be useful to all NASA centers in planning and developing effective environmental stress screens. Information relative to thermal and vibration screens as the most effective methods for surfacing latent failures in electronic equipment at the component level is considered.

50424 Protective circuit for thyristor controlled systems and thyristor converter embodying such protective circuit. Downhower, F.H.; Finlayson, P.T. (to Dept. of Energy). US Patent 4,442,480. 10 Apr 1984. Filed date 24 Feb 1982. vp.

PAT-APPL-351808.

A snubber circuit coupled across each thyristor to be gated in a chain of thyristors determines the critical output of a NOR LATCH whenever one snubber circuit could not be charged and discharged under normal gating conditions because of a short failure.

50425 High power radio frequency attenuation device. Kerns, Q.A.; Miller, H.W. (to Dept. of Energy). US Patent 4,438,367. 20 Mar 1984. Filed date 30 Dec 1981. vp.

PAT-APPL-335996.

A resistor device for attenuating radio frequency power includes a radio frequency conductor connected to a series of fins formed of high relative magnetic permeability material. The fins are dimensional to accommodate the skin depth of the current conduction therethrough, as well as an inner heat conducting portion where current does not travel. Thermal connections for air or water cooling are provided for the inner heat conducting portions of each fin. Also disclosed is a resistor device to selectively alternate unwanted radio frequency energy in a resonant cavity.

50426 Three phase AC motor controller. Nuckovich, M.; Burkett, J.P.; Wright, M.K. (to Dept. of Energy). US Patent 4,438,382. 20 Mar 1984. Filed date 30 Jun 1981. vp.

PAT-APPL-279501.

A motor controller for a three phase AC motor which is adapted to operate bidirectionally from signals received either from a computer or a manual control. The controller is comprised of digital logic circuit means which implement a forward and reverse command signal channel for the application of power through the forward and reverse power switching relays. The digital logic elements are cross coupled to prevent activation of both channels simultaneously and each includes a plugging circuit for stopping the motor upon the removal of control signal applied to one of the two channels for a direction of rotation desired. Each plugging circuit includes a one-shot pulse signal generator which outputs a single pulse signal of predetermined pulsewidth which is adapted to inhibit further operation of the application of power in the channel

which is being activated and to apply a reversal command signal to the other channel which provides a reversed phase application of power to the motor for a period defined by the pulse-width output of the one-shot signal generator to plug the motor which will then be inoperative until another rotational command signal is applied to either of the two channels.

50427 **Modified laser-annealing process for improving the quality of electrical P-N junctions and devices.** Wood, R.F.; Young, R.T. (to Dept. of Energy). US Patent 4,436,557. 13 Mar 1984. Filed date 19 Feb 1982. vp.

PAT-APPL-349959.

The invention is a process for producing improved electrical-junction devices. The invention is applicable, for example, to a process in which a light-sensitive electrical-junction device is produced by (1) providing a body of crystalline semiconductor material having a doped surface layer, (2) irradiating the layer with at least one laser pulse to effect melting of the layer, (3) permitting recrystallization of the melted layer, and (4) providing the resulting body with electrical contacts. In accordance with the invention, the fill-factor and open circuit-voltage parameters of the device are increased by conducting the irradiation with the substrate as a whole at a selected elevated temperature, the temperature being selected to effect a reduction in the rate of the recrystallization but insufficient to effect substantial migration of impurities within the body. In the case of doped silicon substrates, the substrate may be heated to a temperature in the range of from about 200° C. to 500° C.

50428 **Rotary shaft seal.** Langebrake, C.O. (to Dept. of Energy). US Patent 4,424,975. 10 Jan 1984. Filed date 25 Apr 1983. vp.

PAT-APPL-488300.

The invention is a novel rotary shaft seal assembly which provides positive-contact sealing when the shaft is not rotated and which operates with its sealing surfaces separated by a film of compressed ambient gas whose width is independent of the speed of shaft rotation. In a preferred embodiment, the assembly includes a disc affixed to the shaft for rotation therewith. Axially movable, non-rotatable plates respectively supported by sealing bellows are positioned on either side of the disc to be in sealing engagement therewith. Each plate carries piezoelectric transducer elements which are electrically energized at startup to produce films of compressed ambient gas between the confronting surfaces of the plates and the disc. Following shutdown of the shaft, the transducer elements are de-energized. A control circuit responds to incipient rubbing between the plate and either disc by altering the electrical input to the transducer elements to eliminate rubbing.

50429 **Capacitively-coupled inductive sensor.** Ekdahl, C.A. (to Dept. of Energy). US Patent 4,438,394. 20 Mar 1982. Filed date 13 Apr 1981. vp.

PAT-APPL-253490.

A capacitively coupled inductive shunt current sensor which utilizes capacitive coupling between flanges having an annular inductive channel formed therein. A voltage dividing capacitor is connected between the coupling capacitor and ground to provide immediate capacitive division of the output signal so as to provide a high frequency response of the current pulse to be detected. The present invention can be used in any desired outer conductor such as the outer conductor of a coaxial transmission line, the outer conductor of an electron beam transmission line, etc.

4209 Waste Processing Plants And Equipment

50430 **Zigzag configurations and air classifier performance.** Peirce, J.J.; Wittenberg, N. (Dept. of Civil and Environmental Eng., Duke Univ., Durham, NC). *Journal of Energy Engineering;* **110**: No. 1, 36-48(Mar 1984).

The fundamental aspects of zigzag air classifier configurations are studied in terms of the design and operation of a waste-to-energy production facility. The development of a method of performance evaluation defined by operating range is examined. Historically, air classification has been used in industry and agriculture in mineral extraction, limestone sizing, and seed and grain cleaning. However, the adaption of air classifiers to resource recovery and waste-to-energy production facilities presents new problems due to the complex and variable nature of the wastes. A series of configurations providing a continuous range of zigzag classifier shape components are tested. Each configuration is evaluated to determine its efficiency of separation, and sensitivity to operating air speeds. Results indicate that the configuration of a zigzag classifier does not influence its peak efficiency of separation. However, findings point to distinct limits on operating parameters which lead to peak efficiencies for the different configurations. These operating range values represent the sensitivity of the air classifier to changes in the air flow. A major finding concerns the effect of configuration on the particle size distribution observed in the material exiting the classifier: smaller particles appear to be influenced by configuration changes and larger particles do not. A new method for classifier performance evaluation is developed and applied.

4210 Combustion Systems

50431 **(EPRI-AP—3651) Thermoeconomic analysis of power plants. Final report.** Tsatsaronis, G.; Winhold, M. (Nevada Univ., Reno (USA). Desert Research Inst.). Aug 1984. 205p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920024.

In this report, the concept of exergy and the general methodology of the exergetic analysis and the thermoeconomic (combined exergetic and economic) analysis of energy conversion systems are presented. The THESIS (THermodynamic and Economc SImulation System) computer program used for these analyses is briefly described. Detailed mass, energy, exergy and money balances for a reference steam power plant (Harry Allen Station) are shown. The effect of the most important process parameters on the overall efficiency is investigated. A year-by-year and a levelized revenue requirement analysis are presented. The costs of exergy losses are compared with the capital costs and other expenses due to owning and operating each particular plant component. The question whether it is profitable to reduce the exergy losses by increasing these costs and vice versa is investigated. A cost sensitivity analysis including the effect of coal price and average annual capacity factor is performed. The methodology applied in this report appears to be useful in analyzing and evaluating energy conversion systems. The analyses presented here allow identification and evaluation of the inefficiencies and the opportunities for improvement of an energy conversion process. Results indicate that modifications in certain process parameters can lead to a decrease in the cost of electricity produced by the reference plant.

50432 **(PB—84-209097) Brief review of planned R and D (research and development) in the LIMB (Limestone Injection Multistage Burner) development program.** Rakes, S.L. (Environmental Protection Agency, Research Triangle Park, NC (USA). Industrial Environmental Research Lab.). Jun 1984. 14p. (EPA/600—D-84-164). NTIS, PC A02/MF A01.

The paper is a brief review of work planned and work underway in support of the Limestone Injection Multistage Burner (LIMB) development effort. A detailed description of the equipment used in the Innovative Furnace in-house effort is given. Work plans for contracts and a cooperative agreement with Acurex Corporation, Energy and Environmental Research Corporation, and Southern Research Institute covering internally staged burner work, fundamental combustion research, staged fuel NOx reduction, tangential-fired furnace pilot project, and LIMB particulate emissions are reviewed. The in-house work on limestone properties and reactivity and sorbent properties/fundamental chemistry is mentioned. The planned 'super sorbents' and graphite drop-tube furnace work are covered. No results are discussed. Mention is made of lime-based sorbents with surface area of over 60 sq m/g as measured by a B.E.T. unit using N2 as the absorbed gas. Tests on furnaces ranging in size from 2.9 W to 29 MW are planned. Particle size distributions of total furnace emissions, before control devices, in the 0.1 micrometer range are to be measured. Reduction of both SOx and NOx is one goal of the effort.

50433 **(PB—84-210129) Combustion efficiency optimization manual for operators of oil- and gas-fired boilers. Final report.** Wunderle, J.A.; Ponder, T.C. (PEDCo-Environmental, Inc., Cincinnati, OH (USA)). Sep 1983. 70p. NTIS, PC A04/MF A01.

This manual provides general guidance to operators of oil- and gas-fired boilers to increase boiler efficiency, improve fuel consumption, and to reduce pollutant emissions. Boiler operating principles and suggestions to improve boiler performance are discussed. Combustion is explained in simple terms. Various heat losses are described, and suggestions are given on means to minimize or eliminate heat losses. The manual describes boiler adjustments for peak operating efficiency, optimum fuel consumption, and reduced pollutant emissions. Efficiency, fuel consumption, and emissions are all sensitive to many of the same boiler operating parameters. This manual describes feasible operating techniques and combustion adjustments to achieve clean, safe, and efficient boiler operation.

50434 **(PB—84-211259) Application of reburning for NO(x) control to a firetube package boiler. Report for April 1983-March 1984.** Mulholland, J.A.; Lanier, W.S. (Environmental Protection Agency, Research Triangle Park, NC (USA). Industrial Environmental Research Lab.). Jun 1984. 20p. (EPA/600—D-84/170). NTIS, PC A02/MF A01.

Presented at ASME Joint Power Generation Conference, Toronto, Canada, October 3-4, 1984. Prepared in cooperation with Acurex Corp., Research Triangle Park, NC.

The paper describes the use of a 730-kW (2.5 million Btu/hr) firetube package boiler, to demonstrate the application of reburning for NOx emission control. An overall reduction of 50 percent from an uncontrolled NOx emission of 200 ppm was realized by diverting 15 percent of the total boiler load to a natural-gas-fired second stage burner. Tests indicate that the overall order of destruction (with respect to initial NOx) is greater than one; thus, larger reductions can be expected from reburning applications to systems with higher initial NOx. Rich zone stoichiometry has been identified as the dominant process variable. Primary zone stoichiometry and rich zone residence time are parameters that can be adjusted to maximize NOx reduction. Reburning applied to firetube package boilers requires minimal facility modification. Natural gas would appear to be an ideal reburning fuel, because nitrogen in the reburning fuel has been shown to inhibit NOx reduction.

50435 **Transient axial solid and gas temperature profiles in the grid zone of a gas-solid fluidized bed.** Song, J.C.; Fan, L.T.; Yutani, N. (Department of Chemical Engineering, Kansas State University, Manhattan, Kansas). *Industrial and Engineering Chemistry Fundamentals;* **23**: No. 2, 170-174(May 1984).

The transient axial particle and gas temperature profiles in different regions near the distributor of a gas-solid fluidized bed at gas velocities near minimum fluidization were measured by means of highly sensitive thermocouple probes. Qualitative or semiquantitative accounts are presented of the thermal behavior of these regions where rapid heat transfer has been known to occur between the particles and fluidizing medium.

4230 Marine Engineering

REFER ALSO TO CITATION(S) 42300050112, 50581

50436 **(SI-R—810220-1) High reliability instrumentation systems.** Haraldsen, H.P. (Sentralinstitutt for Industriell Forskning, Oslo (Norway)). Oct 1981. 38p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. File Number DE84751652.

The report contains reliability predictions for a proposed subsea instrumentation system intended for monitoring subsea well heads. It is shown how the reliability can be improved by redundancy, and by how much. 13 figures, 3 tables.

4240 Pollution Control Equipment

REFER ALSO TO CITATION(S) 42400049388, 49389, 49391, 49392, 49393, 49394, 49395, 49754, 49755, 50434

50437 (DOE/METC—84-6, pp 299-308) **Electrocyclone development program.** Christensen, D.; Giles, W.; Palmer, P. (General Electric Co., Schenectady, NY). Dec 1983. NTIS, PC A21/MF A01. File Number DE84000216. (CONF-8305112—).

From 3. annual contractors' meeting on contaminant control in hot coal derived gas streams; Washington, PA, USA (24 May 1983).

Recent electrocyclone cold flow testing has demonstrated that the combined separative parameter which incorporates inertial forces and electrostatic forces can be used to correlate performance over a range of inlet velocities, particle sizes, field strengths and cyclone diameters. Electrocyclone testing culminated in the high pressure and temperature test (1625°F, 94 psia, 7 pps and 3 gr/acf) of a 12-inch ID high flow electrocyclone at GE's Corporate Research and Development Combustion Laboratory. Inlet velocities of 10 to 140 ft/sec were explored and resulted in overall efficiencies of 90 to 98 percent respectively. The cyclone performed as predicted by the scaling parameter; i.e., it adequately predicts viscosity effects. A mechanical failure and inadequate cooling of the electrode precluded obtaining data with electrostatic augmentation. 4 references, 14 figures.

50438 **(PB—84-207679) Results of the first two years of commercial operation of an organic-acid-enhanced FGD (flue gas desulfurization) system. Final report April 1982-April 1984.** Glover, R.L.; Brown, G.E.; Dickerman, J.C.; Hargrove, O.W. (Radian Corp., Austin, TX (USA)). Jun 1984. 66p. (RAD—83-203-001-53-19). NTIS, PC A04/MF A01.

The report documents the first 2 years (1982 and 1983) of commercial operation of the dibasic acid (DBA) system at Springfield's Southwest Power Plant (SWPP), during which SWPP averaged an SO2 emission rate of less than 1.0 lb SO2/million Btu. (NOTE: EPA has sponsored research to develop organic-acid-enhanced flue gas desulfurization (FGD) technology for existing and new coal burning facilities. A 1981 EPA-sponsored demonstration program at SWPP, near Springfield, MO, showed that adipic acid and DBA greatly enhanced FGD performance. SWPP has continued to use DBA to comply with the 1971 SO2 emissions standard under which they are regulated. Thus, SWPP became the first commercial-scale system to use an organic additive to enhance SO2 removal). At SWPP in 1980 (before DBA addition), SWPP averaged about 5 lb SO2/million Btu. FGD system reliability was also greatly improved, averaging 97.9% in 1982 and 98.7% in 1983, compared to 45% in 1980. The SO2/O2 continuous emissions monitoring system also showed excellent reliability, exceeding 97%. Overall, DBA has increased the flexibility of the SWPP system and, most importantly, allowed SWPP to operate in compliance.

50439 **Interstitial flow intensification within packed granular bed filters: Experiments and theory.** Snaddon, R.W.L.; Dietz, P.W. (General Electric Company, Corporate Research and Development, Schenectady, New York). *Industrial and Engineering Chemistry Fundamentals;* **23**: No. 2, 147-153(May 1984).

The mechanical collection efficiency of a granular bed filter is determined by the flow within the bed. In spite of the demonstrable sensitivity of existing models to their proposed flow structures, most do not attempt accurate characterization of the flow. In particular, interstitial flow intensification and flow separation are usually neglected. In the present paper an analytic model and collection measurements are combined to examine these effects. A potential flow model is developed in which the magnitude of the flow intensification is characterized by a single "intensification parameter". The experimental data are then employed to develop a unique correlation of this parameter with Reynolds number.

4250 Power Cycles

REFER ALSO TO CITATION(S) 42500049676

50440 (NP—4751642) Low-temperature heat utilization in production of electric or mechanical power Organic Rankine Cycle System. Part-report comprehending instrumentation and computer measurement program. Smedegaard, J. (Risoe National Lab., Roskilde (Denmark)). 1983. 110p. (In Danish). NTIS (US Sales Only), PC A06/MF A01. File Number DE84751642.

This report deals with experimental measuring set up to an electrical power producing system. This system is based on the Organic Rankine Cycle technology. The experimental set up is placed at Roskilde's waste incinerator plant KARA I/S. The report contains an outline of the transducers and a description of the software for the data acquisition and for the thermodynamic calculations. In addition the report contains a short operation manual. The microcomputer used for the data-acquisition is a ABC80. The measured values is sent to the Danish National Laboratory Risoe from the experimental set up at KARA I/S via the telephone network. The data here at Risoe is presented on a data screen.

43 PARTICLE ACCELERATORS

50441 (ANL-HEP-CP—84-62) Radiation damage in an ethylamine-borane:ammonia target. Crabb, D.G.; Hill, D. (Michigan Univ., Ann Arbor (USA); Argonne National Lab., IL (USA)). 27 Aug 1984. Contract W-31-109-ENG-38. 6p. (CONF-8409134—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017492.

From 4. workshop on polarized target materials and techniques; Bonn, F.R. Germany (2 Sep 1984).

A polarized target of ethylamine + borane-ammonia + EHBA-Cr(V) was exposed to an integrated beam flux of 10^{14}cm^{-2}. The polarization is shown as a function of proton irradiation. (DLC)

4301 Design, Development, And Operation

REFER ALSO TO CITATION(S) 43010049572, 50820

50442 (BNL—35084) Proton laser accelerator by means of the inverse free electron laser mechanism. Zakowicz, W. (Brookhaven National Lab., Upton, NY (USA)). Jul 1984. Contract AC02-76CH00016. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000231.

The inverse free electron laser accelerator is considered to be a potential high gradient electron accelerator. In this accelerator electrons oscillating in the magnetic field of a wiggler can gain energy from a strong laser beam propagating collinearly. The same mechanism of acceleration can work for protons and all other heavier particles. One can expect that the proton acceleration will be less effective, as it is more difficult to wiggle a heavier particle. It is indeed so, but this less efficient coupling of the proton and laser beam is partly compensated by the negligible radiative losses. These losses impose restrictions on the electron acceleration above 100 Gev. 6 references, 2 figures.

50443 (CONF-8309168—7) 10-GeV heavy-ion collider. Young, G.R.; Martin, J.A.; Ball, J.B. (Oak Ridge National Lab., TN (USA)). 1983. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001140.

From 3. international conference on ultra-relativistic nucleus-nucleus collisions; Upton, NY, USA (26 Sep 1983).

This paper presents a brief report on a study for a relativistic heavy-ion collider covering an energy span from 1 GeV on 1 GeV to 10 GeV on 10 GeV. This energy range was selected as most appropriate for exploitation of the baryon-rich region of relativistic nucleus-nucleus collisions. The study was done prior to the Wells College meeting of the NSAC Long-Range Plan Working Group which recommended a collider with tip energy of 30 GeV on 30 GeV. The present work has not been modified to reflect this higher top energy but some remarks will be made at the end about changes needed to reach these energies. The basic elements of the facility would remain much the same.

50444 (CONF-8405193—44) Accelerator-colliders for relativistic heavy ions or in search of luminosity. Young, G.R. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001870.

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

Some issues pertinent to the design of collider rings for relativistic heavy ions are presented. Experiments at such facilities are felt to offer the best chance for creating in the laboratory a new phase of subatomic matter, the quark-gluon plasma. It appears possible to design a machine with sufficient luminosity, even for the heaviest nuclei in nature, to allow a thorough exploration of the production conditions and decay characteristics of quark-gluon plasma.

50445 (FNAL/C—84/73-T) SSC parameters: what physics demands. Quigg, C. (Fermi National Accelerator Lab., Batavia, IL (USA)). 1984. Contract AC02-76CH03000. 3p. (CONF-8406198—7). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017259.

From Design and utilization of the superconducting super collider summer study; Snowmass, CO, USA (23 Jun 1984).

Issues of energy and luminosity for the SSC are briefly reviewed.

50446 (LA—10080-C) Proceedings of the seventeenth LAMPF Users Group meeting. Bradbury, J.N. (comp.). (Los Alamos National Lab., NM (USA)). Apr 1984. Contract W-7405-ENG-36. 182p. (CONF-8311144—). NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE84014134.

From 17. LAMPF users group meeting; Los Alamos, NM, USA (7 Nov 1983).

The seventeenth annual LAMPF Users Group meeting was held November 7-8, 1983, at the Clinton P. Anderson Meson Physics Facility. The program included a number of invited talks on various aspects of nuclear and particle physics as well as status reports on LAMPF. A panel discussion on the LAMPF II concept provided an exchange of views among an advisory group, Users, and LAMPF staff. The LAMPF working groups met and discussed plans for each of the secondary beam lines.

50447 (LA-UR—84-3007) LAMPF II. Thiessen, H.A. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-48. 18p. (CONF-841117—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE85002043.

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

We present a plan for two rapid-cycling synchrotrons - a 45-GeV, 40 μA proton synchrotron with a 9-GeV, 200-μA booster. These machines can provide simultaneously 45-GeV slow-extracted beam for the production of kaons, antiprotons, and other secondary particles, and 9-GeV fast-extracted beam for neutrino and pulsed muon physics. The LAMPF II machines are compared with existing and proposed kaon factories. Relative to the Brookhaven AGS as it exists today, LAMPF II will provide 90 times as many neutrino events per year and 300 times as many kaons per year. Some design features of the LAMPF II accelerators that are important for reducing beam losses and increasing beam availability are discussed. Because of the large rf power and voltage required, an innovative design of the ferrite-tuned cavities is necessary. A commercially available Mg-Mn ferrite with perpendicular bias has been shown to raise the available ferrite Q by more than a factor of 10 when compared with materials now in use at other accelerators. The 45-GeV LAMPF II synchrotron would produce far more neutrinos, kaons, and antiprotons per unit cost than an upgraded conventional machine. The LAMPF II booster by itself, which can provide 100 μA at 12 GeV, is a very interesting option at moderate cost. 5 references, 4 figures, 2 tables.

50448 **(LA-UR—84-3044) CW operation of the FMIT RFQ accelerator.** Cornelius, W.D. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 16p. (CONF-841117—5). NTIS, PC A02/MF A01; GPO Dep. File Number DE85002047.

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

Experiences in attaining cw operation of the radio-frequency quadrupole for the Fusion Materials Irradiation Test facility are presented. Modifications of the vacuum system, changes in the rf structure, and operational experiences are discussed, as well as preliminary results of initial beam-characterization measurements. 4 references, 2 figures.

50449 **High-sensitivity mass spectrometry with a tandem accelerator.** Henning, W. (Argonne National Lab., IL (USA); Technische Univ. Muenchen, Garching (Germany, F.R.). Fakultaet fuer Physik). *Nuovo Cimento [Sezione] A;* **81**: No. 1, 191-200(1 May 1984). Contract W-31-109-ENG-38.

Also published as report CONF–830384–2, 1983, 13 p.

The characteristic features of accelerator mass spectrometry are discussed. A short overview is given of the current status of mass spectrometry with high-energy (MeV/nucleon) heavy-ion accelerators. Emphasis is placed on studied with tandem accelerators and on future mass spectrometry of heavier isotopes with the new generation of higher-voltage tandems.

4302 Beam Dynamics, Field Calculations, And Ion Optics

50450 **(AD-A—141241/0) Collective ion acceleration by a reflexing electron beam: model and scaling. Memorandum report.** Mako, F.M.; Tajima, T. (Naval Research Lab., Washington, DC (USA)). 11 May 1984. 21p. (NRL-MR—5321). NTIS, PC A02/MF A01.

Analytical and numerical calculations are presented for a reflexing electron beam type of collective ion accelerator. These results are then compared to those obtained through experiment. By constraining one free parameter to experimental conditions, the self-similar solution of the ion energy distribution agrees closely with the experimental distribution. Hence the reflexing beam model appears to be a valid model for explaining the experimental data. Simulation shows in addition to the agreement with the experimental ion distribution that synchronization between accelerated ions and electric field is phase unstable. This instability seems to further restrict the maximum ion energy to several times the electron energy.

50451 **(AD-A—141277/4) Flux diffusion and acceleration in a high current modified betatron. Memorandum report.** Grossmann, J.M.; Manheimer, W.M.; Finn, J.M. (Naval Research Lab., Washington, DC (USA)). 10 May 1984. 26p. (NRL-MR—5328). NTIS, PC A03/MF A01.

An analytic and numerical scheme is developed to determine self-consistent equilibria in modified betatrons. As the beam undergoes adiabatic changes, its behavior is determined by a series of time dependent equilibria. At any time these equilibria are characterized by the number of particles in a drift (P sub theta) surface, and the toroidal flux through a P sub theta surface. The evolution of the drift surfaces is followed during beam acceleration and self-flux diffusion, and beam equilibria are found for various levels of flux diffusion compensation. As the beam accelerates, it reaches a certain energy at which it makes a transition from diamagnetic to paramagnetic poloidal drift. This transition is characterized by a change in topology of the P sub thetas. Depending on the change in shape at transition, the new P sub theta surface can either be confined in the liner or run into the liner. Conditions for confined orbits at the transition are given for parameters of the NRL modified betatron experiment. During flux diffusion, it is found that large adjustments in external fields are necessary to maintain equilibrium. It may be possible to overcome this difficulty by placing a set of external coils at the liner to compensate for the decaying eddy currents. When the distribution of currents in these coils mimic the surface currents exactly, no adjustments in external fields are necessary. However, beam equilibrium is very sensitive to the azimuthal error in this distribution.

50452 **(DESY—84-026) RACETRACK - a computer code for the simulation of nonlinear particle motion in accelerators.** Wrulich, A. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Mar 1984. 44p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84752171.

RACETRACK is a computer code to simulate transverse nonlinear particle motion in accelerators. Transverse magnetic fields of higher order are treated in thin magnet approximation. Multipoles up to 20 poles are included. Energy oscillations due to the nonlinear synchrotron motion are taken into account. Several additional features, as linear optics calculations, chromaticity adjustment, tune variation, orbit adjustment and others are available to guarantce a fast treatment of nonlinear dynamical problems.

50453 **(SLAC-CN—280) Using television cameras to measure emittance.** Ross, M. (Stanford Linear Accelerator Center, CA (USA)). 25 Sep 1984. Contract AC03-76SF00515. 16p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000461.

Since the luminosity in a linear collider depends on the horizontal and vertical emittance (ϵ/sub x/, ϵ/sub y/) as $1/\sqrt{(\epsilon/\text{sub x}/\ \epsilon/\text{sub y}/)}$ a possible method for improving the performance would be to decrease one or both of these numbers. Once this has been done in a damping ring for example, great care must be taken to avoid effective emittance growth in the remainder of the collider. Therefore an effort should be made to measure ϵ, (x and y), as accurately as possible, both during machine development and operationally. One technique used for measuring ϵ is to insert a luminescent screen in the path of the beam and measure the size of the spot of light made as the beam passes with a television camera and some associated electronics. This has advantages over sampling type techniques (such as wire scanners) because it provides full pulse to pulse two-dimensional information.

50454 **(SLAC-PUB—3427) Phase displacement acceleration in the SSC.** Hofmann, A. (Stanford Linear Accelerator Center, CA (USA)). Aug 1984. Contract AC03-76SF00515. 2p. (CONF-8406198—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE85001884.

From Design and utilization of the superconducting super collider summer study; Snowmass, CO, USA (23 Jun 1984).

The SSC (Superconducting Super Collider) is supposed to operate with bunched beams and the energy radiated by synchrotron radiation is replaced by the rf-system having a synchronous phase angle slightly different from 180°. Here the case of operating the SSC with a coasting beam is considered. In particular the possibility of replacing the radiated energy phase displacement acceleration is investigated.

50455 **The generation and use of semi-empirical electron transport models.** Garth, J.C. (Rome Air Development Center, Hanscomb AFB, MA 01731). *Transactions of the American Nuclear Society;* **46**: 413-414(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

4303 Auxiliaries And Components

REFER ALSO TO CITATION(S) 43030050453, 51041

50456 **(ANL/PHY—84-2) International Nuclear Target Development Society workshop 1983: proceedings.** Thomas, G. (ed.). (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 270p. (CONF-8309127—). NTIS, PC A12/MF A01; 1; GPO Dep. File Number DE84017599.

From International Nuclear Target Development Society workshop; Argonne, IL, USA (7 Sep 1983).

Separate abstracts were prepared for 11 of the 19 papers presented. Eight papers were previously included in the data base. Discussion group session papers on carbon stripper foils, problems in producing heavy-ion targets, and problems in producing general type targets are included. (WHK)

50457 **(BNL—35133) BNL multiparticle spectrometer software.** Saulys, A.C. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 12p. (CONF-8408109—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85001347.

From Europhysics conference on software engineering, methods and tools in computational physics; Brussels, Belgium (21 Aug 1984).

This paper discusses some solutions to problems common to the design, management and maintenance of a large high energy physics spectrometer software system. The experience of dealing with a large, complex program and the necessity of having the program controlled by various people at different levels of computer experience has led us to design a program control structure of mnemonic and self-explanatory nature. The use of this control language in both on-line and off-line operation of the program will be discussed. The solution of structuring a large program for modularity so that substantial changes to the program can be made easily for a wide variety of high energy physics experiments is discussed. Specialized tools for this type of large program management are also discussed.

50458 **(CONF-840790—3) Status of rf superconductivity at Argonne National Laboratory.** Shepard, K.W. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 16p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002145.

From 2. workshop on rf superconductivity; Geneva, Switzerland (23 Jul 1984).

Work on rf superconductivity at Argonne National Laboratory has, for the past twelve years, focussed on the development of superconducting structures for acceleration of heavy-ions. This work has resulted in the development of several niobium split-ring resonators for the acceleration of particles of velocity $.04 < v/c < .2c$, construction and operation since 1979 of a superconducting booster linac based on these resonators, and currently, the expansion of the booster into the Argonne tandem-linac accelerating system (ATLAS) - a national facility for nuclear structure research. We first give a brief description of the resonators developed for the Argonne superconducting heavy-ion linac. This is followed by a description of the accelerator facility and its operational characteristics. Finally, current resonator development is discussed, together with implications for future upgrading of the ATLAS facility. 12 references, 6 figures, 1 table.

50459 **(CONF-8405113—4) Design of a tensor polarized deuterium target polarized by spin-exchange with optically pumped NA.** Green, M.C. (Argonne National Lab., IL (USA)). May 1984. Contract W-31-109-ENG-38. 36p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85000095.

From Workshop on polarized targets in storage rings; Argonne, IL, USA (17 May 1984).

A proposed design for a tensor polarized deuterium target ($\sim 10^{15}$ atoms/cm^2) for nuclear physics studies in an electron storage ring accelerator is presented. The deuterium atoms undergo electron spin exchange with a highly polarized sodium vapor; this polarization is transferred to the deuterium nuclei via the hyperfine interaction. The deuterium nuclei obtain their tensor polarization through repeated electron spin exchange/hyperfine interactions. The sodium vapor polarization is maintained by standard optical pumping techniques. Model calculations are presented in detail leading to a discussion of the expected performance and the technical obstacles to be surmounted in the development of such a target. 15 references, 10 figures.

50460 **(CONF-8409150—1) Evaluation of target purity using various vacuum systems.** Thomas, G.E.; Rehm, K.E.; Klimczak, G.W. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000075.

From 12. world conference of the International Nuclear Target Development Society; Antwerp, Belgium (25 Sep 1984).

Gold targets were prepared under various conditions using both a cryopump and a conventional diffusion pump evaporator system. Measurements were made at the Argonne Tandem Accelerator system to determine the purity of these targets.

50461 **(GSI—84-24(Prepr.)) Storage ring physics issues for GSI program.** Hofmann, I. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Apr 1984. 9p. (CONF-840142—14). NTIS (US Sales Only), PC A02/MF A01. File Number DE84752157.

From International symposium on heavy ion accelerators and their applications to inertial fusion; Tokyo, Japan (23 Jan 1984).

Plans for a new heavy ion accelerator facility at GSI including a synchrotron and a storage ring have been presented in a different contribution to this symposium. Here we discuss the storage ring physics issues that have been proposed as part of the German Heavy Ion Fusion Program in the period 1985-1989. Rather than giving a complete list of questions that can be raised, we focus on those issues that we have considered as most urgent. Results of computer simulation of high-current beams at GSI will be presented and put into a relationship with the proposed experiments.

50462 **(JINR—D-3,4-82-704, pp 320-341) DIANE-a project for a new high performance neutron source in the Federal Republic of Germany.** Bauer, G.S. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Festkoerperforschung). 1982. NTIS (US Sales Only), PC A23/MF A01. File Number TI84780542. (CONF-820658—).

From 4. international school on neutron physics; Dubna, USSR (8 Jun 1982).

The general concept of DIANE, an intensity modulated neutron source, on the base of linear proton accelerator with pulses of 500 μc duration and a time average thermal neutron flux of $7X10^{14}$ cm^{-2} s^{-1} is given. The description and schematic representation of the rotating target of DIANE are presented. The arrangement of moderators above and below the rotating target is shown. The use of epithermal neutrons by time-of-flight techniques would become possible if the proton pulses could be shortened to less than one microsecond. To achieve this a compressor ring has been studied. Since this ring would also make possible several other uses of the proton beam and the particles produced by it it actually constitutes an integral part of the proposed facility. The project as a whole does require a number of novel developments and concepts in both target and accelerator technology.

50463 **(LA-UR—84-3043) Development of a high current H^- injector for the proton storage ring at LAMPF.** York, R.L.; Stevens, R.R.; DeHaven, R.A.; McConnell, J.R.; Chamberlin, E.P.; Kandarian, R. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 21p. (CONF-841117—4). NTIS, PC A02/MF A01; GPO Dep. File Number DE85002048.

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

A new high-current H^- injector has been installed at LAMPF for the Proton Storage Ring. The injector is equipped with a multicusp surface-production H^- ion source that was developed at LAMPF. The ion source is capable of long-term operation at 20 mA of H^- current at 10% duty factor and with normalized beam emittance of 0.08 cm-mrad (95% beam fraction). Details of the development program, the injector design, and initial operating experience are discussed. Included in the discussion is a comparison of intensity and emittance measurements of the same H^- beam at 100 keV and 750 keV. 4 references, 6 figures.

50464 **(SLAC-PUB—3396) Multimode harmonic power measurement of 40 MW pulsed S-band klystrons.** Fowkes, W.R.; Wu, E.S. (Stanford Linear Accelerator Center, CA (USA); Academia Sinica, Beijing (China). Inst. of Electronics). Aug 1984. Contract AC03-76SF00515. 8p. (CONF-8408108—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001560.

From Conference on precision eletromagnetic measurements; Delft, Netherlands (20 Aug 1984).

An array of 12 calibrated RF electric field probes on the waveguide walls are used to sample the complex field profile at the second and third harmonics where the fundamental power is in the 40 MW range at 2856 MHx. The measured amplitude and phase signals from these are Fourier analyzed to determine with good accuracy the power in each of the many possible propagating modes.

50465 (UCID—20175) Tritium/deuterium gas cell. Hansen, L.F.; Garibaldi, J.L.; Keville, R.; Pohl, B.A. (Lawrence Livermore National Lab., CA (USA)). Sep 1984. Contract W-7405-ENG-48. 14p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000975.

A tritium/deuterium gas cell has been designed as a neutron target to generate a high-energy neutron source, 15 ≦ E/sub n/ ≦ 30 MeV, when bombarded with deuterons up to 12 MeV. The secondary neutrons emitted at 0° from the reactions $^{2}H(d,n)^{3}He$ and $^{3}H(d,n)^{4}He$ are used to study neutron scattering differential cross sections from materials of interest. The resolution needed for these measurements required a monoenergetic neutron beam with an energy spread $\Delta E \sim 100$ keV. This is not possible to achieve at the same source strength with a standard tritium/deuterium loaded solid target, because of the large differential energy spread of the incident deuterons through the target (about 160 keV compared to 30 keV in the gas cell filled to 1 atm.). The present gas cell, 3 cm long and with a 7 μm Mo window, produces 9.3×10^{7} or 2.4×10^{7} neutrons when filled with one atmosphere of deuterium or tritium respectively, for 1.0 μA deuteron current.

50466 (ZfK—516) State and development of ion sources for accelerators. Dietrich, L. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Jan 1984. 34p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE84703147.

A review of state and development of ion sources for accelerators with emphasis on the production of intense and high charge state ion beams is given. Various ion sources are described and compared.

50467 Fermilab central helium liquefier operations. Hodge, G.A.; Rihel, R.K.; Stone, M.W.; Walker, R.J. (Fermi National Accelerator Laboratory, Batavia, Illinois). pp 461-468 of Advanced cryogenic engineering. Vol. 29. Fast, R.W. New York, NY, USA; Plenum Press (1984). (CONF-830841—).

From Cryogenic engineering conference; Colorado Springs, CO, USA (15 Aug 1983).

This chapter discusses the use of liquid helium to cool the Fermilab superconducting accelerator. Liquid from the Central Helium Liquefier (CHL) is transported in a six kilometer circular transfer line and each satellite withdraws the amount required to boost its refrigeration capacity to the necessary level. Topics considered include the compressor, the heater, the control system, gas storage, liquid storage, the nitrogen reliquefier, gas purification, initial and early operation, and recent operation. The liquid helium is warmed to near ambient temperature in the satellite heat exchangers. The satellite compressors return the excess inventory to the CHL via a 20 bar gas header. This gas is injected into the high pressure supply to the cold box. Some turbine instabilities have been experienced, including the destruction of a turbine during the initial start-up.

50468 Fermilab satellite refrigerator compressors with oil and moisture removal systems. Satti, J.A.; Andrews, R.A. (Fermi National Accelerator Laboratory, Batavia, Illinois). pp 453-460 of Advanced cryogenic engineering. Vol. 29. Fast, R.W. New York, NY, USA; Plenum Press (1984). (CONF-830841—).

From Cryogenic engineering conference; Colorado Springs, CO, USA (15 Aug 1983).

This chapter describes the use of twenty eight Mycom compressors in the Tevatron refrigeration system. Each Mycom skid consists of an oil injected screw compressor of 58 g/s capacity with a 350 hp motor. Helium gas returning from the low pressure gas header is compressed from 1 atm to 20 atm. The compressed helium gas is then passed through a purification system where oil mist, oil vapor, water vapor and particulate are sequentially removed and injected into a high pressure gas header. A Fermilab Mycom process gas compressor system consists of the compressor, direct drive motor, lube oil reservoir, lube oil pumps, lube oil cooler, oil filters, oil removal system, compressor inlet strainer, aftercooler, local control panel and controls. Topics considered include the oil coalescer, the oil drain, adsorbent beds, and the final filter. It is determined that a critical gas velocity of 0.5 m/s is needed to prevent oil re-entrainment from the wet surfaces.

50469 Fermilab's satellite refrigerator expansion engines. Peterson, T.J. (Fermi National Accelerator Laboratory, Batavia, Illinois). pp 443-451 of Advanced cryogenic engineering. Vol. 29. Fast, R.W. New York, NY, USA; Plenum Press (1984). (CONF-830841—).

From Cryogenic engineering conference; Colorado Springs, CO, USA (15 Aug 1983).

This chapter examines the use of Koch Model 1400 expanders and Gardner-Fermi engines in satellite refrigerators. Each of Fermilab's 24 satellite refrigerators includes two reciprocating expanders, a "wet" engine and a "dry" engine. Each engine has inlet and exhaust pressure gages, a cylinder pressure transducer, inlet and exhaust vapor pressure thermometers with gages, and an hour meter. Topics considered include thermodynamic performance (efficiency, mass flow rate and power) and mechanical performance. It is suggested that with a well-organized engine monitoring and maintenance program and one eight-hour shift each week for inspections and greasing, engine reliability will not be a problem for accelerator operations.

50470 Control of the Tevatron Satellite Refrigeration system. Theilacker, J.; Chapman, L.; Gannon, J.; Hentges, M.; Martin, M.; Rode, C.H.; Zagel, J. (Fermi National Accelerator Laboratory, Batavia, Illinois). pp 437-441 of Advanced cryogenic engineering. Vol. 29. Fast, R.W. New York, NY, USA; Plenum Press (1984). (CONF-830841—).

From Cryogenic engineering conference; Colorado Springs, CO, USA (15 Aug 1983).

This chapter describes a computerized control system for 24 satellite refrigerators which cool a six kilometer ring of superconducting magnets. The control system consists of 31 independent microprocessors operating over 400 servo loops, and a central computer system which provides monitoring, alarms, logging and changing of parameters. Topics considered include pressure measurement, flow measurement, temperature measurement, gas analysis, control valves, expansion engine controllers, and control loops. Each refrigerator has 12 active microprocessor based control loops which tune the refrigerator to one of its four operating modes: satellite, liquefier, refrigerator, and stand-by. It is suggested that optimizing the refrigerator control loops and quench recovery scheme will minimize the accelerator down time.

50471 Commissioning of the Tevatron Satellite Refrigeration system. Theilacker, J.; Andrews, R.A.; Ferry, R.; Gannon, J.; Lincincome, T.; Makara, J.; Martin, M.; Misek, J.; Mizicko, D. (Fermi National Accelerator Laboratory, Batavia, Illinois). pp 429-436 of Advanced cryogenic engineering. Vol. 29. Fast, R.W. New York, NY, USA; Plenum Press (1984). (CONF-830841—).

From Cryogenic engineering conference; Colorado Springs, CO, USA (15 Aug 1983).

This chapter describes the cooling of the new Fermilab 6 km circumference superconducting proton accelerator by a 5000 L/h central helium liquefier (CHL) coupled with 24 satellite refrigerators (966W each). The Tevatron Satellite Refrigeration system includes a liquid helium/liquid nitrogen transfer line made up of twenty six-250 m long sections. Topics considered include transfer line operation, compressor system operation, satellite refrigeration operational experience, contamination, expansion engine efficiency, control loop stability, pressure drop, the magnet system operational experience, magnet cooldown, vacuum deficiencies, and magnet excitation. It is concluded that the satellite refrigerator concept has proven to be a reliable design for the Tevatron.

50472 Automation of a cryogenic facility by commercial process control computer. Sondericker, J.H.; Campbell, D.; Zantopp, D. (Brookhaven National Lab., Upton, NY). pp 421-427 of Advances cryogenic engineering. Vol. 29. Fast, R.W. New York, NY, USA; Plenum Press (1984). (CONF-830841—).

From Cryogenic engineering conference; Colorado Springs, CO, USA (15 Aug 1983).

This chapter describes the control aspects of a production magnet test facility (MAGCOOL) and the advantages afforded the designers by the implementation of a commercial process control computer system. MAGCOOL was designed to ensure that

Brookhaven's superconducting accelerator magnets are reliable and their field quality meets accelerator requirements. Over ten magnet test cycles have been programmed through MAGCOOL. MAGCOOL instrumentation was designed to interface specifically to computer I/O and to rely on the digital system to perform all control, alarming and logic sequencing without the aid of analog meters or controls except where they were embedded as part of commercial equipment. Anatec's CRISP high level process control language is used for application programming. It is concluded that although the system has had a few power and hardware failures plus some leaking valves, MAGCOOL is flexible enough in design to absorb problems and continue to perform.

4304 Storage Rings

50473 (DESY—83-124) Complete snake and rotator schemes for spin polarization in proton rings and large electron rings. Steffen, K. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Nov 1983. 23p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84751510.

In order to maintain spin polarization in proton rings and large electron rings, some generalized Siberian Snake scheme may be required to make the spin tune almost independent of energy and thus avoid depolarizing resonances. The practical problem of finding such schemes that, at reasonable technical effort, can be made to work over large energy ranges has been addressed before and is here revisited in a broadened view and with added new suggestions. As a result, possibly optimum schemes for electron rings (LEP) and proton rings are described. In the proposed LEP scheme, spin rotation is devised such that, at the interaction points, the spin direction is longitudinal as required for experiments.

50474 (GSI—84-25(Prepr.)) Suppression of microwave instabilities. Hofmann, I. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Apr 1984. 11p. (CONF-840142—13). NTIS (US Sales Only), PC A02/MF A01. File Number DE84752156.

From International symposium on heavy ion accelerators and their applications to inertial fusion; Tokyo, Japan (23 Jan 1984).

The longitudinal resistive microwave instability in storage rings has been identified in previous workshops as a key problem in heavy ion fusion. Here we show by means of computer simulation that the predictions from the linearized theory of instability are over-pessimistic in the case of non-relativistic ions. This is due to an early nonlinear saturation of the instability caused by the formation of a thin stabilizing tail of the momentum distribution, which provides enough Landau damping of suppress further growth. The main condition for this non-destructive self-stabilization lies in the slow resistive growth rate, as compared with the large coherent frequency shift induced by space charge. The important conclusion from this is a significant extension of the stable storage ring filling time to values that are comfortable from a design point of view. For the HIBALL reactor driver accelerator a safe storage time of 5 - 10 msec is expected, instead of only 1 msec according to the linearized theory e-folding times.

50475 (N—84-20847) Experimental investigation of the characteristics of an ultraviolet storage ring laser. Madey, J.M.J. (Stanford Univ., CA (USA)). Mar 1983. 15p. (AD-A—137751; AFOSR—84-0094TR). NTIS, PC A02/MF A01.

Experimental hardware and instrumentation were installed and used to study laser-induced bunch lengthening, gain, diffraction effects, and subthreshold behavior in a ACO storage ring free electron laser. Electron beam heating and laser damage are discussed.

44 INSTRUMENTATION

4401 Radiation Instrumentation

REFER ALSO TO CITATION(S) 44010050457, 50768

50476 (AD-A—141288/1) Integrating dosimeter for pulsed radiation. Cappelli, J.R. (Rome Air Development Center, Griffiss AFB, NY (USA)). Dec 1983. 16p. (RADC-TR—83-273). NTIS, PC A02/MF A01.

A Pulsed Radiation Dosimetry System designed to measure radiation produced by particle accelerators is described. The problems associated with total-dose measurement of irregular shaped pulses of ionizing radiation have been simplified. The system responds to extremely narrow pulses of charged particles or X-rays using a pin diode as the detector. Direct readout of dose in rads (Si) is displayed on a 3-1/2 digit digital panel meter. The system will operate in either the multiple-pulse or single-pulse mode. The multiple-pulse mode would be useful in monitoring or tuning a linear accelerator. In the single-pulse mode the system will automatically display total dose of a transient event in real time and hold that measurement indefinitely or until the next measurement is made. The system features an automatic reset in either mode.

50477 (GKSS—84/E/3) Sequential Analyse of the data of a monitor for radioactive radiation. Priesmeyer, H.G. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1984. 22p. (In German). NTIS (US Sales Only), PC A02/MF A01. File Number DE84751918.

A sequential method to analyse counter data differences is described. Results of Monte Carlo calculations and first measurements are given.

50478 (INIS-mf—9052, pp 26) **Application of holography in trace detectors of high resolution.** Bartke, E.; Ivanov, I.; Scherbakov, A. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1983. (In Bulgarian). NTIS (US Sales Only), PC A99/MF A01. File Number TI84780548. (CONF-8309253—Absts.).

From 1. national congress of the physicists in Bulgaria; Sofia, Bulgaria (28 Sep 1983).

Published in summary form only.

50479 (INIS-mf—9052, pp 27) **Detectable limits of low-level concentration of the radionuclides.** Dimchev, T. (Vissh Selskostopanski Inst., Plovdiv (Bulgaria)). 1983. (In Bulgarian). NTIS (US Sales Only), PC A99/MF A01. File Number TI84780548. (CONF-8309253—Absts.).

From 1. national congress of the physicists in Bulgaria; Sofia, Bulgaria (28 Sep 1983).

Published in summary form only.

50480 (KFK—3726) Dose estimation by simultaneous measurement of the radon/thoron concentration and the equilibrium factors in air using a passive dosemeter. Urban, M. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Sicherheit; Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Elektrotechnik). Mar 1984. 113p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE84751930.

Responsible for an increased radiation exposure is the inhalation of radon and its short lived daughters. A time integrating passive dosemeter was developed to determine the concentrations of the radon isotopes as well as their equilibrium factors. The α energy spectrum inside a dosemeter is measured by means of a nuclear track detector. The concentrations in air and the equilibrium factors are calculated by using a new mathematical dosemeter model. A small pilot study in houses was done to test the dosemeter.

50481 (LA-UR—84-2906) Monte Carlo error analysis in x-ray spectral deconvolution. Shirk, D.G.; Hoffman, N.M. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 16p. (CONF-840922—7). NTIS, PC A02/MF A01; GPO Dep. File Number DE85002024.

From 5. APS topical conference on high temperature plasma diagnostics; Tahoe City, CA, USA (16 Sep 1984).

The deconvolution of spectral information from sparse x-ray data is a widely encountered problem in data analysis. An often-neglected aspect of this problem is the propagation of random error in the deconvolution process. We have developed a Monte Carlo approach that enables us to attach error bars to unfolded x-ray spectra. Our Monte Carlo error analysis has been incorporated into two specific deconvolution techniques: the first is an iterative convergent weight method; the second is a singular-value-decomposition (SVD) method. These two methods were applied to an x-ray spectral deconvolution problem having m channels of observations with n points in energy space. When m is less than n, this problem has no unique solution. We discuss the systematics of non-unique solutions and energy-dependent error bars for both methods. The Monte Carlo approach has a particular benefit in relation to the SVD method: it allows us to apply the constraint of spectral non-negativity after the SVD deconvolution rather than before. Consequently we can identify inconsistencies between different detector channels. 4 references, 6 figures.

50482 (LBL—18259) Cerenkov detector for heavy-ion velocity measurements. Olson, D.L.; Baumgartner, M.; Dufour, J.P.; Girard, J.G.; Greiner, D.E.; Lindstrom, P.J.; Symons, T.J.M.; Crawford, H.J. (Lawrence Berkeley Lab., CA (USA)). Aug 1984. Contract AC03-76SF00098. 7p. (CONF-8409158—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002067.

From Conference on instrumentation for heavy-ion nuclear research; Oak Ridge, TN, USA (22 Sep 1984).

We have developed a highly sensitive velocity measuring detector using total-internal-reflection Cerenkov counters of a type mentioned by Jelly in 1958. If the velocity of the particle is above the threshold for total-internal-reflection these counters have a charge resolution of $\sigma = 0.18e$ for a 3mm thick glass radiator. For the velocity measurement we use a fused silica radiator so that the velocity of the particles are near the threshold for total-internal reflection. For momentum-analyzed projectile fragments of 1.6 GeV/nucleon ^{40}Ar, we have measured a mass resolution of $\sigma = 0.1u$ for isotope identification.

50483 (OEFZS—4274) Method for non contacting gauging of the wall thickness of tubes by backscattering of radiation. Frevert, E. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). Mar 1984. 32p. (In German). (IA—128/84). NTIS (US Sales Only), PC A03/MF A01. File Number DE84703144.

A method is described to make a non contacting rapid and precise estimation of the wall thickness of steel tubes as well as the maximum and the minimum by the aid of backscattering of ^{137}Cs gamma rays. The construction of the measuring head is given. By fitting the measured backscattering values to defined curves a mathematical expression for the influences of the opposite tube wall and the tube diameter was found. By making two measurements on exactly opposed places every pair of values can be assigned unmistakably to the corresponding wall thickness if the diameter is well known. By gauging on four positions each staggered at 90deg C the maximum and minimum can be calculated. The obtainable accuracy is given by an estimation of errors.

50484 (ORNL/TM—9153) Hadron-lepton cascade calculations (1-20 GeV) for a Pb-Al-lucite calorimeter. Alsmiller, F.S.; Gabriel, T.A.; Alsmiller, R.G. Jr. (Oak Ridge National Lab., TN (USA)). Aug 1984. Contract AC05-84OR21400. 45p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85001692.

The results of Monte Carlo calculations for π^- (1- to 20-GeV) and e^- (1- to 10 GeV) normally incident on the center of a cylindrical calorimeter are presented. The calorimeter design has 60 unit cells of alternating Pb-Al-Lucite plates and is a simplified model of one to be used at the Stanford Linear Accelerator Center. General characteristics of the total and spatial energy deposition are given. Pulse height spectra, as well as spectra of the transverse fractional energy distributions and of their first and second moments, are given to aid in hadron-lepton discrimination. Sampling fluctuations are also examined for this purpose. Some results for the effects of a uniform probability of incidence over central transverse strip and also some longitudinal discriminants are presented.

50485 (PB—84-184209) Characteristics of a radon diffusion chamber with electrical collection using plastic nuclear track detectors. Open file report 31 August 1982-30 November 1983. Frank, A.L.; Benton, E.V. (San Francisco Univ., CA (USA)). Sep 1982. 18p. NTIS, PC A02/MF A01.

A portable radon diffusion chamber was tested with electrical collection of radon daughter nuclei for enhancement of sensitivity. The detector was small enough to be worn suspended from a belt. With a battery-supplied high voltage, the sensitivity was found to be 1.43 tracks/sq cm per pCi-h/lambda of ambient radon at 50% relative humidity. The track densities on the surfaces of the CR-39 plastic nuclear track detectors were found to be nonuniform, making the determination of average densities with high accuracy difficult. The fabrication of electrets for use in the detector was investigated in accordance with published techniques with negative results.

50486 (PNL-SA—11931) Evaluation of a draft standard on performance specifications for health physics instrumentation: results for environmental tests. Kenoyer, J.L.; Swinth, K.L.; Mashburn, K.R.; Selby, J.M. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1984. Contract AC06-76RL01830. 26p. (CONF-840627—11). NTIS, PC A03/MF A01; GPO Dep. File Number DE85000369.

From 29. annual meeting of the Health Physics Society; New Orleans, LA, USA (3 Jun 1984).

Draft ANSI Standard N42.17 on performance specifications for health physics instrumentation is currently being evaluated by the Pacific Northwest Laboratory. Evaluation is performed by testing a cross-section of currently available instruments with testing procedures based on specifications of the standard and then determining the degree of conformance to the various elements of the proposed standard. Data will be presented on the performance of a cross-section of beta-gamma survey instruments under various environmental tests. Test results that will be presented include temperature effects, humidity effects, radio frequency (r.f.) susceptibility, ambient pressure effects, vibration effects, and shock effects. Tests performed to date show that most instruments will meet the temperature, humidity, and ambient pressure tests. A large variability is noted among instruments from the same or different vendors. Preliminary r.f. susceptibility tests have shown large artificial responses at some frequencies for specific instruments. The presentation will also include a discussion of procedures used in the testing and weaknesses identified in the proposed standard.

50487 (AAEC-LIB/Trans—773) Guide and instructions for determining γ-ray emission rates with germanium detector systems. Debertin, K. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). 1983. Translation of PTRB-Ra-12, Sep 1980. 79p. NTIS (US Sales Only), PC A05/MF A01. File Number DE84780623.

The most important aspects in planning, performing and evaluating gamma-ray emission-rate measurements by means of Ge-spectrometers are reviewed. Principal topics are: detector properties, possible measuring geometries, electronics, peak evaluation, calibration and corrections. Suggestions are made for carrying out the measurements and for determining uncertainties of the results. An appendix contains decay data of frequently used or frequently occurring radionuclides.

50488 Spatial resolution of neutron-position scintillation detectors. Strauss, M.G.; Brenner, R.; Chou, H.P.; Schultz, A.J.; Roche, C.T. (Argonne National Lab., IL (USA)). pp 175-187 of Proceedings of the workshop on position-sensitive detection of thermal neutrons, 11-12 October 1982, held at the Institut Laue-Langevin, Grenoble, France. Convert, P. (Institut Max von Laue - Paul Langevin, 38 - Grenoble (France)); Forsyth, J.B. (Rutherford Appleton Lab., Chilton (UK)) (eds.). London, England; Academic Press (1983). (CONF-821074—).

From Workshop on position-sensitive detection of thermal neutrons; Grenoble, France (11 Oct 1982).

A neutron PSD has been developed for the Intense Pulsed Neutron Source at Argonne. A pulsed source has a broad spectrum of neutron energies in which a greater fraction of the flux is in the epithermal range. Secondly there is a high instantaneous neutron flux. The detector should therefore have a high neutron detection efficiency extending to epithermal energies and a high instantaneous count rate capability. This detector is comprised of an array of photomultiplier tubes (PMTs) coupled to a thin ^{6}Li-glass scintillator. The principle of operation is similar to that of an Anger gamma-ray camera used in nuclear medicine. The operation and performance of the detector are described. The parameters which affect the spatial resolution are examined and resolution measurements and calculations are reported. Suggestions to improve resolution are made.

50489 High position resolution and accuracy in ^{3}He two-dimensional thermal neutron PSDs. Fischer, J.; Radeka, V.; Boie, R.A. (Brookhaven National Lab., Upton, NY (USA)). pp 129-140 of Proceedings of the workshop on position-sensitive detection of thermal neutrons, 11-12 October 1982, held at the Institut Laue-Langevin, Grenoble, France. Convert, P. (Institut Max von Laue - Paul Langevin, 38 - Grenoble (France)); Forsyth, J.B. (Rutherford Appleton Lab., Chilton (UK)) (eds.). London, England; Academic Press (1983). (CONF-821074—). Contract AC02-76CH00016.

From Workshop on position-sensitive detection of thermal neutrons; Grenoble, France (11 Oct 1982).

Advances made at BNL in position sensing methods and in gas mixture studies have made possible the development of neutron position sensitive detectors with significantly improved position resolution, position accuracy and uniformity of response. A position resolution in the range of 1 - 1.5 mm (FWHM), an integral nonlinearity better than +- 0.1% and uniformity of response of +- 2 - 3% (peak-to-peak) are readily achieved independently of the detector size. These detectors operate at a moderate pressure (5-6 atm) with a ^{3}He - C_3H_8 mixture at very low required avalanche gain (approx. 30) by virtue of the high precision, centroid-finding position readout.

50490 Recent developments in position-sensitive neutron counting. Valentine, K.H.; Kopp, M.K.; Guerrant, G.C.; Harter, J.A. (Oak Ridge National Lab., TN (USA)). pp 149-159 of Proceedings of the workshop on position-sensitive detection of thermal neutrons, 11-12 October 1982, held at the Institut Laue-Langevin, Grenoble, France. Convert, P. (Institut Max von Laue - Paul Langevin, 38 - Grenoble (France)); Forsyth, J.B. (Rutherford Appleton Lab., Chilton (UK)) (eds.). London, England; Academic Press (1983). (CONF-821074—). Contract W-7405-ENG-26.

From Workshop on position-sensitive detection of thermal neutrons; Grenoble, France (11 Oct 1982).

^{3}He-CF_4 and Ar-CF_4 mixtures have been shown to have the potential of improving the count rate capability, spatial resolution and photon discrimination of neutron position-sensitive proportional counters (PSPCs) and fission counters. A large area (65cm x 65cm) PSPC camera has been developed in support of the US National small angle neutron scattering (SANS) facility. It has been shown that RC encoding parameters and construction methods could be scaled up for these larger area PSPCs. With the new counter gas mixtures, position-sensitive transmission line fission counters (TLFCs) for neutron flux monitoring and a one-dimensional curved PSPC for large-angle (130°) neutron diffraction experiments have been developed. The main objective was to extend the LC-encoding method by mitigating the effects of interelectrode capacitance thereby increasing the count rate capability.

50491 Fast parallel encoding scheme for the Anger camera. Seeger, P.A. (Los Alamos National Lab., NM (USA)). pp 188-191 of Proceedings of the workshop on position-sensitive detection of thermal neutrons, 11-12 October 1982, held at the Institut Laue-Langevin, Grenoble, France. Convert, P. (Institut Max von Laue - Paul Langevin, 38 - Grenoble (France)); Forsyth, J.B. (Rutherford Appleton Lab., Chilton (UK)) (eds.). London, England; Academic Press (1983). (CONF-821074—).

From Workshop on position-sensitive detection of thermal neutrons; Grenoble, France (11 Oct 1982).

An Anger camera is a position-sensitive scintillation detector with a continuous scintillator and a relatively small number of photomultipliers. Light from any one event disperses through a coupling plate to strike several photomultipliers. An air gap between the scintillator and the disperser limits the divergence of the photons by total internal reflection, and the radius of the distribution is proportional to the thickness of the disperser. The camera layout is illustrated and described. The basic unit for two-dimensional position determination is a "receptive field" of seven photomultipliers, the detector illustrated has three overlapping fields. In the standard Anger camera, position is determined by finding the centroid of the photomultiplier signals from weighted sums over all tubes of the array. The simplest case (a single field of seven tubes) is described first and then it is shown how this can be expanded to arbitrary size by combining simple circuits. Attention is drawn to the close analogy of this circuit to the structure (and function) of vertebrate visual cortex.

50492 Data processing in neutron protein crystallography using position-sensitive detectors. Schoenborn, B.P. (Brookhaven National Lab., Upton, NY (USA)). pp 321-331 of Proceedings of the workshop on position-sensitive detection of thermal neutrons, 11-12 October 1982, held at the Institut Laue-Langevin, Grenoble, France. Convert, P. (Institut Max von Laue - Paul Langevin, 38 - Grenoble (France)); Forsyth, J.B. (Rutherford Appleton Lab., Chilton (UK)) (eds.). London, England; Academic Press (1983). (CONF-821074—).

From Workshop on position-sensitive detection of thermal neutrons; Grenoble, France (11 Oct 1982).

Accurate Fourier maps depicting atomic structure of proteins to a high precision are needed to take advantage of the unique features of neutron crystallography. An analysis of the observed scattering length of the unexchangeable hydrogen bound to the peptide alpha carbons gives an indication of the minimum error to be expected. A histogram showing the observed variation in the scattering length of Hsub(α) in a myoglobin derivative gives a distribution with a width $>$ 1.2 Fermi units (FWHM). This minimal observed error affects the precision of observable hydrogen exchange fraction X = (P 3.7)/10.3, the scattering length of a proton being -3.7 F and that of a deuteron + 6.6 F. The observed relative scattering length (P) of atoms is subject to experimental conditions, errors in phasing and structural and molecular disorder, as well as the statistical precision of measured structure factors. Techniques are described for minimising error in the observed structure factors by optimizing data collection and analysis procedures. Special attention is given to subtraction of the high background associated with hydrogen-containing molecules which produces a disproportionately large statistical error.

50493 Summary of position-sensitive detector workshop Institut Laue-Langevin, Grenoble, France 11-12 October 1982. Lander, G.H. (Argonne National Lab., IL (USA)); Allemand, R. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Lab. d'Electronique et de Technologie de l'Informatique). pp 418-424 of Proceedings of the workshop on position-sensitive detection of thermal neutrons, 11-12 October 1982, held at the Institut Laue-Langevin, Grenoble, France. Convert, P. (Institut Max von Laue - Paul Langevin, 38 - Grenoble (France)); Forsyth, J.B. (Rutherford Appleton Lab., Chilton (UK)) (eds.). London, England; Academic Press (1983). (CONF-821074—).

From Workshop on position-sensitive detection of thermal neutrons; Grenoble, France (11 Oct 1982).

The workshop brought together electronic engineers designing or making position sensitive detectors PSDs and scientists using them. The development, technology, construction and applications were covered in the 38 papers given at the workshop. This paper gives a general view of PSDs past, present and future.

4403 Miscellaneous Instruments

REFER ALSO TO CITATION(S) 44030049424, 50291, 50399, 50746, 50928, 51042

50494 (CONF-8403150—2) Instrumentation for occupational health research. Vo-Dinh, T.; Hawthorne, A.R. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 28p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85000974.

From DOE-OHER workshop on monitoring and dosimetry in an occupational health research program for synfuel technologies; Knoxville, TN, USA (20 Mar 1984).

Assessment of the state-of-the-art in instrument development and identification of monitoring needs requiring new or improved instrumentation are two key elements of a program in Occupational Health Research for new energy technologies. This article provides an overview of the current status of research on monitoring instrumentation and methods relevant to occupational health research and identifies some of the key issues that must be addressed. The review and discussion are intended to provide a platform for discussions and deliberation by the panel of experts assembled to consider the role of instrumentation in conjunction with the other components of a quality research program for occupational health. Recommendations for research focus and identification of issues that have not received proper attention will be forthcoming from the panel.

50495 (CONF-8409148—1) Filling the gap through teleoperation. Hamel, W.R.; Miller, G.N. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 3p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000912.

From Artificial intelligence and robotics symposium; Indianapolis, IN, USA (12 Sep 1984).

50496 (DP—1674) Advanced mass spectrometers for hydrogen isotope analyses. Chastagner, P. (comp.). (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Jun 1984. Contract AC09-76SR00001. 90p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85000716.

Two advanced prototype mass spectrometers for the accurate analysis of mixtures of the hydrogen isotopes were evaluated. One, a VG-Isotopes GAZAB, was developed for the Mass Spectrometer Technical Group, a group representing ten DOE contractors. The other, a MAT 250 HDT, was developed independently by Varian MAT (now Finnigan MAT) after extensive discussions with Du Pont personnel. The GAZAB is a large double-focusing instrument with a resolution of 2000 at mass 4 and an abundance sensitivity of $>$ 100,000 for the HT-D_2 doublet. The MAT 250 HDT is a smaller, simpler, stigmatic focusing instrument with exceptionally high ion intensities ($>$ 1 x 10^{-9} A at 600 and about 1 x 10^{-10} A at 1300 resolution) for high signal-to-noise ratios. Both instruments are computer controlled. Once a scan is started, peak switching, scanning, mass discrimination control, data collection and data reduction are done without operator intervention. Utility routines control hysteresis effects and instrument calibration. A containment facility, with dual inlet systems and a standard distribution system, permits testing with tritium mixtures. Helium flow standards and tritium activity meters provide independent verification of the mass spectrometer calibrations. A recovery system prevents the release of tritium to the environment. The performance of the mass spectrometers was essentially equal under simulated process control conditions. Precision and accuracy for the D/T ratio was $<$ 0.5% (rel 2σ limits). Performance factors were: sample equilibration $<$ 300 ppM; linearity within +- 0.3%; and gas interference $<$ 0.1%. Mass discrimination was controlled reliably by the computers. Therefore, single focusing instruments are suitable for routine control laboratory operations. Double-focusing instruments are only needed for special applications. SRL/SRP personnel worked closely with both manufacturers in this program.

50497 (EGG-PBS—6689) Binary thermoelectric level detector. Wilkins, S.C. (EG and G Idaho, Inc., Idaho Falls (USA)). Aug 1984. Contract AC07-76ID01570. 20p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000342.

A thermoelectric liquid-level detector has been developed which permits measurement of liquid level at 2/sup n/ distinct elevations by the use of n, thermoelectric loops. This presents a distinct improvement over previous thermocouple detection devices, which require a separate thermocouple circuit for each level detected. This new device comprises several differential thermocouple circuits, each composed of segments of a positive thermoelectric material alternating with segments of a negative thermoelectric material. The existence of a temperature gradient on a pair of segments results in either a positive or a negative thermoelectric voltage. The sequence of positive- and negative-polarity signals from the set of thermoelectric loops provides a unique binary word corresponding to a particular elevation on the probe. The principle of operation, a prototype assembly, and its application in both open and closed, insulated vessels are discussed.

50498 (LA-UR—84-2943) Application of layered synthetic microstructures to high-temperature plasma diagnostics. Day, R.H.; Barbee, T.W. (Los Alamos National Lab., NM (USA); Stanford Univ., CA (USA). Dept. of Physics). 1984. Contract W-7405-ENG-36. 29p. (CONF-840922—6). NTIS, PC A03/MF A01; GPO Dep. File Number DE85002035.

From 5. APS topical conference on high temperature plasma diagnostics; Tahoe City, CA, USA (16 Sep 1984).

Layered Synthetic Microstructures, LSM's, are a new type of manmade x-ray diffracting element which can be applied to a broad variety of diagnostic applications. The ability to use the synthesis process to engineer the properties of the LSM allow the designer of x-ray diagnostics to construct many novel instruments. The state-of-the-art in LSM fabrication is reviewed, and some unique spectrometers are described that have been designed and fielded to provide what is unachievable with conventional designs. An experiment is underway to understand the properties of LSM's intense heat loads. 9 references, 7 figures.

50499 (LA-UR—84-3015) Simulation of bent crystal spectrometers. Kyrala, G.A. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 12p. (CONF-8409157—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85002042.

From 5. topical conference on high temperature plasma diagnostics; Lake Tahoe, NV, USA (16 Sep 1984).

In crystal spectrometers one traditionally labels each position in the dispersion/recording plane by a single wavelength value. A simple examination of the crystal spectrometers shows that different areas of the crystal contribute different wavelengths at the same position in the recording plane. Using collimators and apertures one may reduce these effects, as well as reduce the collected signal. Convolving the system response, in that case, may not allow simple analytic estimates of the sensitivity/responsivity of the system. A Monte-Carlo ray-trace program was written in order to study and simulate the real geometry including finite source size effects. The results of using the code will be presented, demonstrating the contributions to the resolution and absolute responsivity, for a particular parabolically bent crystal spectrometer.

50500 (PINSTECH/NPD—102) Description and repair procedure for optical digitizers PAC-4. Hayat, M.K.; Ahmad, M.S.; Beg, M.M. (Pakistan Inst. of Nuclear Science and Technology, Islamabad. Nuclear Physics Div.). Jun 1982. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703163.

The optical digitizer type PAC-4 is an optical analogue-to-digital converter with parallel read out. The optical digitizer is intended for digital measurements of angular rotation of its shaft. In this application the control shaft of the digitizer is coupled to a wheel, which moves on the carriage of the respective spectrometer axes, and indicates its angular position. For accurate determination

of the selected neutron energies, it is important to measure the diffraction angles very accurately.

50501 **(SAND—84-1738C) Photonic methods of high speed analog data recording.** Chang, J.; Filter, W.F.; Lockwood, G.J.; Neyer, B.T. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 33p. (CONF-840887—12). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84016723.

From 16. international congress on high speed photography and photonics; Strasbourg, France (27 Aug 1984).

We propose a photonic high speed analog data recording system that, when compared to conventional oscilloscope-based systems, offers economy, higher bandwidth, electrical isolation, and compactness. The basis of this approach is to record photon analog signals rather than electron analog signals. A prototype High Speed Multi-Channel Data Recorder has been developed as a key component. Initial applications of this photonic system in pulsed power experiments have already shown its versatility and usefulness. The system, including photonic sensors, is described and its overall impact in diagnostic technology is discussed.

50502 **(SAND—84-1806C) NBS frequency measurement system from a user's viewpoint.** Booker, S.R.; Jones, M.C. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 17p. (CONF-8410145—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016782.

From National conference of standards laboratories; Gaithersburg, MD, USA (1 Oct 1984).

During 1983, the National Bureau of Standards announced the availability of a new Frequency Measurement Service for standard oscillators of high stability. Two standards laboratories at Sandia National Laboratories have subscribed to that service, and as a result have been supplied by the National Bureau of Standards with hardware, software, consultation, and a continuing program of standard oscillator evaluation. This paper discusses the motivation for subscribing to the new service, experience in setting up the systems at Sandia, system reliability, some preliminary observations about accuracy, and possible system enhancements. All of the material is presented from the viewpoint of a new user of the service.

50503 **(SAND—84-8234) Medium speed computer interface (digitizer) for general purpose data acquisition.** Van Hook, A.R. (Sandia National Labs., Livermore, CA (USA)). Aug 1984. Contract AC04-76DR00789. 42p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85001585.

A simple NIM (Nuclear Instrument Module) compatible analog to digital converter which offers significant improvements over commercial units has been developed. The converter has a 2μs A/D and will digitize unipolar signals ranging in amplitude from one millivolt to ten volts. A key feature is the precision track-and-hold amplifier which is a front end for the analog-to-digital converter circuitry producing conversion accuracies of 0.01% in 500 ns. The settling time and the conversion time allow for a maximum data rate of 500 kHz with a total system nonlinearity of 0.06%.

50504 **(TVA/OP/EDT—84/30) Microprocessor-based monitoring and control project. Phase I report.** (Tennessee Valley Authority, Chattanooga (USA). Div. of Energy Demonstrations and Technology). Jan 1984. 75p. NTIS, PC A04/MF A01. File Number DE84901974.

This report summarizes the activities of Phase I of the Microprocessor-Based Monitoring and Control Project. This project is part of an ongoing effort in the Electrical Systems Group of TVA's Division of Energy Demonstrations and Technology (ED & T) to develop microprocessor-based systems for special-purpose applications in the monitoring of power system parameters and the control and protection of power system apparatus to improve power operations. The system presently configured receives its voltage and current signals from conventional potential and current transformers. However, under a separate project, ED & T will test and evaluate electro-optic and magneto-optic voltage and current sensors for eventual use with microprocessor-based systems. This report specifically describes the initial activities performed in configuring the microprocessor-based system to monitor and compute power system parameters at the Concord 161-kV Substation. In the next phase, the system will be expanded to simulate the switching of the 46-kV capacitor banks for voltage and reactive control at the substation.

45 EXPLOSIONS AND EXPLOSIVES

4501 Chemical

REFER ALSO TO CITATION(S) 45010050303, 50419

50505 **(MHSMP—84-36) Evaluation of end-cap-less tensile specimen for explosive testing.** Neff, G.W. (Mason and Hanger-Silas Mason Co., Inc., Amarillo, TX (USA)). Sep 1984. Contract AC04-76DP00487. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001805.

Tensile specimens fabricated from explosive formulations have in the past utilized end caps which were adhesively bonded to the specimens. To reduce testing costs and eliminate end cap usage entirely, a new specimen was designed. This specimen has bell-shaped ends which allows the use of reusable tooling grips during testing and quick change of specimens between tests. To understand the effect of various features of the geometry of the specimen on stress distribution within the specimen, a computerized Finite Element Analysis (FEA) study was conducted. While the effect of several geometric features upon stress distribution is discussed in the report, a recommended combination of features is provided. These features include a bell angle of 25° (50° included) with a machining tolerance of 0.1°; a blend radius of 25 mm; a test section diameter of 10 mm; and a cylindrical test section length of 40 mm.

50506 **(UCRL—91565) Experimental high pressure equation of state of a very fast burning gun propellant.** Costantino, M.; Ornellas, D. (Lawrence Livermore National Lab., CA (USA)). Sep 1984. Contract W-7405-ENG-48. 24p. (CONF-8410149—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85001749.

From JANNAF combustion meeting; Laurel, MD, USA (1 Oct 1984).

We present experimental data on the pressure-volume, compressional and shear wave speeds, and failure strength of an 88% TMD, very fast burning gun propellant. The measurements are carried out in the range 0.1 to 400 MPa at a stress rate of 0.1 MPa/s and at room temperature. The mechanical EOS is dominated by the elastic-plastic response of the pore structure, although precise analysis is complicated by viscoelastic effects with time constants comparable to experimental times. These measurements represent some of very few experimental data available for constitutive relations, and the need for other laboratories to undertake similar experiments is emphasized.

4502 Nuclear

REFER ALSO TO CITATION(S) 45020050290, 50818

50507 **(AD-A—141034/9) Investigation of optimal aimpoints for multiple nuclear weapons against installations in a target complex. Master's thesis.** Boy, E.G. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering). Mar 1984. 175p. NTIS, PC A08/MF A01.

Strategic nuclear targeting studies generally include more target installations than there are weapons. Hence, a weapon is not assigned to an installation, but rather, to a Desired Ground Zero (DGZ). The objective of this study was to investigate optimal DGZs for multiple nuclear weapons against installations in a target complex. To accomplish this, it was necessary to develop the target Complex Expected Damage Function (CEDF) maximization algorithm. The algorithm locates optimal DGZs by maximizing the CEDF; the CEDF is a nonlinear function of 2m variables, the (X sub i, Y sub i) DGZ coordinates for each of the m weapons. The algorithm uses two CEDF models and two optimization techniques. These models use DIA Physical Vulnerability System probability of

damage models. The CEP-Included model includes each weapon's CEP; the simpler CEP-Excluded model assumes each weapon's CEP equals 0. An analytical expression for the gradient of the CEP-Excluded model was calculated; the algorithm maximizes this CEDF using a conjugate gradient with restarts search technique. The algorithm maximizes the CEP-Included CEDF using a direct search technique, Powell's method of conjugate directions. This investigation characterized three factors that affect the optimal DGZ locations for multiple nuclear weapons in a target complex. The first factor was gradient symmetry; this symmetry resulted from either a geographically symmetric target complex or collocated weapons. The second factor was weapon CEP. Maximization of the two CEDF models produced slightly different optimal DGZs; this difference depended on a weapon's CEP and the CEDF model.

50508 **(AD-A—141092/7) BRIK, an interactive, goal programming model for nuclear exchange problems. Master's thesis.** Bunnell, R.E.; Takacs, R.A. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering). Mar 1984. 260p. NTIS, PC A12/MF A01.

BRIK, unique nuclear exchange model (NEM), is the first NEM to be both totally interactive and to rely entirely upon preemptive goal programming to drive its allocations. Written in Fortran 77 it exists on the VAX 11-798 using the UNIX operating system. Since it includes as internal allocation subroutine, it is completely transportable. BRIK will allocate weapons to targets in order to meet damage expectancy (DE) goals of the user. The decision variable is a non-integer geometric mean representing the number of weapons allocated to an entire target class, using any of 3 objective functions and up to 13 different allocation rules. The program is useful for a wide range of scenarios including meeting DE goals with the available arsenal or creating an arsenal to meet established goals. The programmed model uses a preemptive linear goal programming algorithm, allowing explicit preferential treatment of target classes, which can be placed into any of 7 priorities. Target values can be input to differentiate target classes within the same priority. BRIK computes single shot probability of survival using DIA's nuclear targeting vulnerability system or from vulnerability expressed as a PSI overpressure number. As currently dimensioned, the program can handle up to 20 target classes, 20 weapon classes, and 20 hedging constraints.

50509 **(AD-A—141312/9) Concept for operations in a nuclear environment. Technical report.** Oliver, H.W.; Smiley, R.H.; Theroux, G.L. (JAYCOR, Alexandria, VA (USA)). 18 Jun 1982. 142p. NTIS, PC A07/MF A01.

This paper provides a concept for the conduct of military operations by US Army forces in a nuclear environment; sets forth issues impacting the implementation of the US Army's operational concept for the conduct of the Air-Land Battle. It considers warfighting at corps and below in a nuclear environment; influences and constraints external to corps, while recognized, are not explicitly addressed. The concept is equally applicable in an inactive nuclear environment wherein nuclear use has not occurred, but is possible or imminent; it can be expanded to include operations in a combined conventional-nuclear-chemical environment. There are two basic elements of a nuclear battlefield environment which must be understood and mastered by US forces: the effective employment of nuclear weapons in both offensive and defensive operations; the increased vulnerability of forces and the resultant requirement for implementation of extraordinary survivability and reconstitution measures.

50510 **(AD-A—141339/2) E-fields parallel-to-b effects on plasma shear across magnetic flux tubes. Technical report.** Kilb, R.W. (Mission Research Corp., Santa Barbara, CA (USA)). 26 Oct 1983. 44p. (MRC-R—770). NTIS, PC A03/MF A01.

Necessary conditions are derived if very long plasma filaments (striations) are to remain magnetic flux tube aligned in distorted geomagnetic fields subsequent to nuclear burst. Special E fields are required, unrelated to resistive effects. It is not yet clear if such special E fields can appear in reality. If such special E fields cannot exist, long nuclear bursts striations in the magnetosphere will gradually shear across magnetic flux tubes, break up into several shorter segments, descend into the lower ionosphere, and be consumed faster there by molecular deionization.

50511 **(AD-A—141340/0) Study of field aligned plasma acceleration during a HANE (High Altitude Nuclear Explosion). Technical report.** Brecht, S.H.; Orens, J.H. (Berkeley Research Associates, Inc., CA (USA)). 1 Mar 1983. 70p. NTIS, PC A04/MF A01.

Research was undertaken to determine if field aligned acceleration of plasma will occur following a High Altitude Nuclear Event (HANE). This report represents the preliminary phase of the research. Particle codes were used to study this nonlinear problem in one and two and one-half dimensions using the electrostatic limit. Examination of beam plasma interaction in one dimension showed the expected diffusion of plasma to high energy consistent with previous research. The two and one-half dimension simulations were performed where a loss cone in the velocity distribution was studied. These simulations indicated that the loss cone distribution does not appear to be energetic enough to accelerate plasma along magnetic field lines with superthermal velocity.

50512 **(UCRL—53566) New downhole cable emplacement method developed for LLNL's Nuclear Test Program.** Day, J.A. (Lawrence Livermore National Lab., CA (USA)). 25 Jul 1984. Contract W-7405-ENG-48. 22p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001950.

This report describes the characteristics and advantages of the cable downhole system (CDS), a new method of emplacing diagnostic cables for underground testing of nuclear devices. The CDS has been developed by Lawrence Livermore National Laboratory for its nuclear test program at the Nevada Test Site (NTS). In the conventional procedure, a crane lowers the cables down the hole, which ranges in depth from 600 to 2300 ft. This method requires many labor craft disciplines, considerable standby time, and a large amount of hardware installation. Completing the whole operation can take 10 or more working days. Although this method of operation is inefficient, it has evolved over many years and has proven safe and reliable. The new cable downhole system controls the tension on each cable as the nuclear device is lowered into the emplacement hole with all cables attached. The system consists of units of tensioners, called skids, which are assembled into appropriate field configurations. Each skid is a self-contained platform holding 10 tensioners when completely assembled. During the downhole operation, a computer monitors and controls the performance of the tensioners. One hundred cables can be lowered or retracted with the current system. The CDS is safe, reliable, and has a number of advantages over the conventional downhole method.

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

REFER ALSO TO CITATION(S) 50000050714

5001 Basic Studies

REFER ALSO TO CITATION(S) 50010049554, 50522, 50654

50513 **(N—84-20844) Shot noise limited detection of OH using the technique of laser induced fluorescence.** Bakalyar, D.M.; Davis, L.I. Jr.; Guo, C.; James, J.V.; Kakos, S.; Morris, P.T.; Wang, C.C. (Wayne State Univ., Detroit, MI (USA); Ford Motor Co., Dearborn, MI (USA)). 1984. 30p. (NASA-CR—175433). NTIS, PC A03/MF A01.

Nearly shot-noise limited detection of OH using the technique of laser-induced fluorescence is reported. A LIDAR configuration is used to excite fluorescence in a large volume and a narrow-bandwidth interference filter provides spectral discrimination. This arrangement alleviates the effect of ozone interference and facilitates image processing at relatively close distances. The detection limit is determined mainly by the shot-noise of the solar background. Ground-based measurements in Dearborn indicate a detection limit of better than 1 x 10 to the 6th power OH/cubic cm over a forty-minute acquisition period. Under favorable conditions, a comparable detection limit was also observed for airborne measurements.

50514 (N—84-20982) Method to estimate the vertical dispersion parameter in a 10 Km range. Xiaoen, L.; Xinyuan, J.; Jinte, Y. (Air Force Systems Command, Wright-Patterson AFB, OH (USA)). Dec 1983. 17p. (AD-A—137192; FTD-ID(RS)T—1647-83). NTIS, PC A02/MF A01.

Based on the Monin-Batchelor Similarity Theory and the concept of effective roughness length, this paper presented an empirical vertical dispersion model in a 10 kilometer range. It could be used under a flat and homogeneous, as well as complex, topographical condition.

50515 (STF—88A83011) Ekofisk E-data. Data report: Jan-Jun 1982. Faevelen, M; Torsethaugen, K. (Otter Group, Trondheim (Norway)). Feb 1983. 125p. NTIS (US Sales Only), PC A06/MF A01. File Number DE84751644.

The data presented are collected and reported as part of the E (en- vironmental)- and P (platform)- data programme instigated by the Norwegian Petroleum Directorate. The data have been recorded by the platform operator at the Ekofisk field in the North Sea. Parameters recorded for waves include: significant wave height, mean zero crossing period, max wave height, period of highest wave, and wave spectrum with bandwith 0.01 Hz. The wind data include: mean vector speed over the last 9 min sampled before each hour, mean vector direction over the same period, max 3 s gust encountered during same 9-min period, max vector mean speed calculated over 9 min found during preceding hours. In addition air pressure, air temperature, humidity/dewpoint, and water temperature have been recorded. The report contains 109 data sheets.

50516 (STF—88A83016) Statfjord E-data. Data report: Jan-Dec 1982. Faevelen, M; Torsethaugen, K. (Otter Group, Trondheim (Norway)). Mar 1983. 142p. NTIS (US Sales Only), PC A07/MF A01. File Number DE84751643.

The data presented are collected and reported as a part of the E (environmental) and P (platform) - data programme instigated by the Norwegian Petroleum Directorate. The data have been recorded by the platform operator at the Statfjord field in the North Sea. The parameters recorded include significant wave heigth 1 to 2 km off the platform, and for wind: speed and direction, 10 and 20 min mean values, and max 3 s gust speed. Meteorological data include 10 min mean values for air temperature, dew point and air pressure. The bulk of the data are presented in 190 plots.

50517 (STF—88A85024) Statfjord E-data. Data report: Jan-Dec 1981. Faevelen, M.; Torsethaugen, K. (Otter Group, Trondheim (Norway)). Apr 1983. 133p. NTIS (US Sales Only), PC A07/MF A01. File Number DE84751645.

The data presented are collected and reported as a part of the E (environmental)- and P (platform)- data programme, instigated by the Norwegian Petroleum Directorate. The data have been recorded by the platform operator at the Statfjord field in the North Sea. The parameters recorded include significant wave height 1 to 2 km off the platform, and for wind: speed and direction, 10 and 20 min mean values, and max 3 s gust speed, Meteorological data include 10 min mean values for air temperature, dew point and air pressure. The bulk of the data are presented in 172 plots.

50518 Signal averaging limitations in heterodyne- and direct-detection laser remote sensing measurements. Menyuk, N.; Killinger, D.K. (MIT, Lexington, MA). pp 185-190 of Optical and laser remote sensing. Berlin, Germany, F.R.; Springer-Verlag (1983).

The improvement in measurement uncertainty brought about by the averaging of increasing numbers of pulse return signals in both heterodyne- and direct-detection lidar systems is investigated. A theoretical analysis is presented which shows the standard deviation of the mean measurement to decrease as the inverse square root of the number of measurements, except in the presence of temporal correlation. Experimental measurements based on a dual-hybrid-TEA CO2 laser differential absorption lidar system are reported which demonstrate that the actual reduction in the standard deviation of the mean in both heterodyne- and direct-detection systems is much slower than the inverse square-root dependence predicted for uncorrelated signals, but is in agreement with predictions in the event of temporal correlation. Results thus favor the use of direct detection at relatively short range where the lower limit of the standard deviation of the mean is about 2 percent, but advantages of heterodyne detection at longer ranges are noted. 11 references.

50519 Solid-state laser sources for remote sensing. Byer, R.L.; Kane, T. (Stanford Univ., CA). pp 245-256 of Optical and laser remote sensing. Berlin, Germany, F.R.; Springer-Verlag (1983).

Recent progress in slab-geometry and conventional rod Nd:YAG solid-state lasers for applications in remote sensing is presented. Developments in slab geometry lasers, which were aimed at improving pulse energy and tuning range, have been based on the use of a Nd:glass substrate with a zig-zag optical path, with selective Raman shifting in gases and harmonic generation in LiNbO3 and KDP to extend the tuning range into the UV and visible regions. The theoretically predicted advantages of the elimination of birefringence and thermal and stress-induced focusing in the slab-geometry laser have been confirmed in measurements on a test-bed Nd:glass system, and a CW lamp pumped Nd:YAG oscillator, which have also demonstrated an order of magnitude improvement in laser performance. A single axial mode Nd:YAG oscillator has also been designed which, operating in a 3-msec quasi-CW mode, has a chirp rate of 30 kHz/microsec and a free-running stability of + or - 20 MHz. With chirp compensation, this stability is adequate for wind velocity measurements by coherent lidar. 17 references.

5002 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 50020049385, 49400, 49401, 49403, 49404, 49466, 49581, 50152, 50292, 50438, 50547, 50572, 50574, 50631, 50636, 50639, 50650, 50651

50520 (BNL—35207) Attempted measurement of gaseous H_2O_2 in the ambient atmosphere. ten Brink, H.M.; Kelly, T.J.; Lee, Y.N.; Schwartz, S.E. (Stichting Energieonderzoek Centrum Nederland, Petten. Energie Studie Centrum; Brookhaven National Lab., Upton, NY (USA)). Apr 1984. Contract AC02-76CH00016. 8p. (CONF-8404191—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001937.

From 3. European symposium on the physico-chemical behavior of atmospheric pollutants; Vareses, Italy (11 Apr 1984).

The concentration of H_2O_2 observed in cloud water is indicative of gas phase concentrations of 0.1 to 1 ppB of H_2O_2 in the atmosphere. Recent direct measurements of gaseous H_2O_2 in the atmosphere proved to be unsuccessful because of artifact formation of H_2O_2 during sampling and analysis. In the existing methods for the determination of the gas, ambient air is passed through impingers to collect H_2O_2 in the aqueous phase. Attempts were made in the present study to overcome the artifact formation of H_2O_2 by trying different types of sampling devices and by using a new analysis technique for the measurement of dissolved H_2O_2. It was found that the artifact H_2O_2 formation occurred irrespective of the type of collector and analysis method. This artifact H_2O_2 formation is evidenced by the presence of comparable concentrations of H_2O_2 in collectors placed in series during air scrubbing. Artifact H_2O_2 was highest in highly photochemically active air masses and only on clean days did the amount of artifact H_2O_2 appear to be low. In laboratory studies generation of artifact H_2O_2 was found to require the presence of O_3 and one or more other unidentified precursors. In an attempt to remove O_3 from ambient air by an aluminum trap artifact H_2O_2 was found. The present observations all indicate the participation of surface reactions in the artifact H_2O_2 formation. The results establish that aqueous sampling of H_2O_2 in ambient air cannot be confidently employed until a means for elimination of artifact H_2O_2 formation is found. Further investigations on the formation of H_2O_2 from O_3 in aqueous solution are in progress. 13 references, 1 figure, 1 table.

50521 (BNL—51542) Health and Environmental Risk Analysis Program workshop: potential public health impacts of airborne organic combustion products. Novak, K.M.; Medeiros, W.H.; Coveney, E.A. (eds.). (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 199p. (CONF-8108134—). NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE84017240.

From Workshop on potential public health impacts of airborne organic combustion products; Upton, NY, USA (17 Aug 1981).

The purpose was to explore various ways of assessing what is known and unknown about health effects of airborne, organic combustion products, and of developing quantitative estimates of such effects, with associated uncertainties. Many US Department of Energy Health and Environmental Assessment Programs (HERAP) projects have made initial assessments of the health effects of organic compounds for their own technologies; the workshop provided an opportunity to share methods and ideas. Health-effects estimates depend on estimates of sources, atmospheric transport, transformation and dispersion, population exposure, dose, and response. Uncertainties in each step are compounded in estimates of health damage. Transport, population exposure, and exposure-response relationships were emphasized. Presentations have been entered individually into the data base. (ACR)

50522 (CONF-840612—17) Recent field studies of dry deposition to surfaces in plant canopies. Lindberg, S.E.; Lovett, G.M.; Bondietti, E.A.; Davidson, C.I. (Oak Ridge National Lab., TN (USA); Carnegie-Mellon Univ., Pittsburgh, PA (USA). Dept. of Civil Engineering). 1984. Contract AC05-84OR21400. 20p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001281.

From Air Pollution Control Association annual meeting; San Francisco, CA, USA (25 Jun 1984).

A variety of field techniques were used to assess the dry deposition of sulfur. In a deciduous forest canopy in eastern Tennessee, inert petri plates and adjacent chestnut oak leaves showed similar SO_4^{-2} deposition velocities of about 0.1 cm s^{-1}. In the same forest, statistical analysis of throughfall yielded a deposition velocity of 0.48 cm s^{-1} for total sulfur (SO_4^{-2} plus SO_2). The throughfall technique appears useful for scaling individual surface measurements to larger spatial and temporal scales. On a grassy field in Illinois, flat Teflon plates, petri dishes, and dustfall buckets were exposed side by side. Measured sulfate deposition increased with increasing rim height on the collection surface, and deposition velocities ranged from 0.14 to 0.70 cm s^{-1}. Much of the deposition to these surfaces can be attributed to large-particle SO_4^{-2}. Dry season (summer) deposition velocities of ^{7}Be in California were found to be similar to dry deposition velocities of ^{212}Pb in Tennessee, ranging from 0.18 to 0.35 cm s^{-1}. These natural radionuclides attach to submicron aerosols in the atmosphere and may be useful tracers of submicron SO_4^{-2} deposition. 9 references, 5 figures, 4 tables.

50523 (CONF-8304203—1) Some aspects of understanding changes in the global carbon cycle. Emanuel, W.R.; Moore, B.; Shugart, H.H. (Oak Ridge National Lab., TN (USA); New Hampshire Univ., Durham (USA). Complex Systems Research Center). 1983. Contract AC05-84OR21400. 57p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85001122.

From Workshop on linkages among the global element cycles; Washington, DC, USA (1 Apr 1983).

Several aspects of our understanding of the carbon cycle from the standpoint of its response to perturbations such as fossil fuel combustion and disturbance to terrestrial ecosystems are reviewed. The status of efforts to reconcile model calculations, observations, and estimates of the magnitude of historical perturbations to the cycle is described. Some refinements in our view of the carbon cycle are suggested. 70 references.

50524 (CONF-8403147—1) Forest growth trends in the eastern United States: status report on empirical and modeling approaches. Dale, V.H.; McLaughlin, S.B. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001094.

From Society of American Foresters (Northeastern Section) annual meeting; Worchester, MA, USA (1 Mar 1984).

Studies of tree growth in northeastern forests are summarized. In addition, an ongoing research project which will use these growth-rate data to simulate the effect of present-day growth rates on northeastern forests is presented. 7 references, 4 figures.

50525 (DOE/ER—0202) Carbon dioxide and climate: summaries of research in FY 1983 and FY 1984. (USDOE Office of Energy Research, Washington, DC. Office of Basic Energy Sciences). Sep 1984. 129p. NTIS, PC A07/MF A01; GPO Dep. File Number DE85001245.

This program summary documents the activities and products of the Carbon Dioxide Research Program in fiscal years 1983 and 1984. The summaries are divided into research areas as follows: carbon cycle; climate and first detection; vegetation response, indirect effects and modification, adaptation, and prevention; scientific interface; and integration and evaluation. (ACR)

50526 (DOE/NBB—0066) Proposed reference set of scenarios for radiatively active atmospheric constituents. Wuebbles, D.J.; MacCracken, M.C.; Luther, F.M. (Lawrence Livermore National Lab., CA (USA)). Oct 1984. Contract W-7405-ENG-48. 52p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85000492.

A set of scenarios for some of the most rapidly changing radiatively active atmospheric constitutents was developed. The suggested time dependent scenarios for historical and future surface concentrations of the examined radiatively active atmospheric constituents are summarized. 79 references, 7 figures, 6 tables. (ACR)

50527 (DOE/TIC—27601) Atmospheric science and power production. Randerson, D. (ed.). (USDOE Technical Information Center, Oak Ridge, TN). Jul 1984. 855p. NTIS $29.50; 1; GPO Dep. File Number DE84005177.

This is the third in a series of scientific publications sponsored by the US Atomic Energy Commission and the two later organizations, the US Energy Research and Development Adminstration, and the US Department of Energy. The first book, Meteorology and Atomic Energy, was published in 1955; the second, in 1968. The present volume is designed to update and to expand upon many of the important concepts presented previously. However, the present edition draws heavily on recent contributions made by atmospheric science to the analysis of air quality and on results originating from research conducted and completed in the 1970s. Special emphasis is placed on how atmospheric science can contribute to solving problems relating to the fate of combustion products released into the atmosphere. The framework of this book is built around the concept of air-quality modeling. Fundamentals are addressed first to equip the reader with basic background information and to focus on available meteorological instrumentation and to emphasize the importance of data management procedures. Atmospheric physics and field experiments are described in detail to provide an overview of atmospheric boundary layer processes, of how air flows around obstacles, and of the mechanism of plume rise. Atmospheric chemistry and removal processes are also detailed to provide fundamental knowledge on how gases and particulate matter can be transformed while in the atmosphere and how they can be removed from the atmosphere. The book closes with a review of how air-quality models are being applied to solve a wide variety of problems. Separate analytics have been prepared for each chapter.

50528 (EPRI-EA—3671) Regional air quality model assessment and evaluation. Final report. Ruff, R.E.; Nitz, K.C.; Ludwig, F.L.; Bhumralkar, C.M.; Shannon, J.D.; Sheih, C.M.; Lee, I.Y.; Kumar, R.; McNaughton, D.J. (SRI International, Menlo Park, CA (USA); Argonne National Lab., IL (USA); TRC Environmental Consultants, Inc., Englewood, CO (USA)). Sep 1984. Contract AM03-76SF00115;W-31-109-ENG-38. 264p. NTIS, PC A12/MF A01; 1 - EPRI; GPO Dep. File Number DE85001910.

This report describes the results of a thorough assessment of a representative cross section of existing regional air quality models. A screening process and a rating scheme were applied to

42 models, and 3 were selected for rigorous and comprehensive assessment. For each of the 3 models, the underlying scientific theory was evaluated and compared to the state of the art. Then evaluation of each of the 3 selected models was performed by operating the models and comparing the calculated values with observations. The EPRI Sulfate Regional Experiment (SURE) provided the nucleus of the data base used for model evaluation and model input. Performance measures for each model for a six-hour averaging time were compared for 9 Class I SURE sites. The results show that calculated atmospheric sulfur concentrations from the 3 models are characterized by poor correlations, high biases, high root-mean-square errors, or combinations thereof, when compared to corresponding field measurements. For the most favorable examples, the models account for only 20% or less of the variance in the observations. Monthly averages for January and July were compared to monthly average concentrations for all 54 SURE sites. The spatial correlation coefficients were substantially higher than for the short-term averages. 63 references, 25 figures, 45 tables.

50529 **(FMI-OR—106) Some statistical distributions of air particle trajectories near the ground in Finland.** Savolainen, A.L. (Finnish Meteorological Inst., Helsinki). 1982. 58p. (In Finnish). NTIS (US Sales Only), PC A04/MF A01. File Number DE84751667.

In this investigation, statistical distributions of the trajectories of air particles over Finland have been calculated using synoptic wind observations. The trajectory computations from the period 1970-1979 have been separately carried out for an inland location, Jyvaeskylae irport, and for Loviisa and Olkiluoto nuclear power stations, situated in coastal areas of the Gulf of Finland and the Gulf of Bothnia respectively. According to the results, the deviation of the trajectories from their initial directions is already quite noticeable at distances of a few tens of kilometres. In particular, turning of the trajectories due to coastal effects is observable in conditions easterly to south-easterly winds over the coast of the Gulf of Finland, and with south to south-west winds over the coast of the Gulf of Bothnia. The statistical distribution of trajectories is of importance when studying average values of the spread of airborne pollutants and their concentrations at ranges of some tens to some hundreds of kilometres from the source.

50530 **(KHM-TR—76) Mercury species present in smoke from coal fire. Water soluble mercury species in air and precipitation.** Brosset, C. (Statens Vattenfallsverk, Vaellingby (Sweden). Projekt KOL-HAELSA-MILJOE). Aug 1983. 86p. (In Swedish). NTIS (US Sales Only), PC A05/MF A01. File Number DE84751665.

In order to elucidate the content and chemical behaviour of mercury species present in smoke from coal fire a number of measurements have been undertaken. Samples from Vaesteraas thermal power plant, AB Papyrus Moelndal and a pilot plant at Studsvik Energiteknik AB, Studsvik have been analyzed with respect to metallic vapor (Hg degree) and water soluble compounds (Hg^1)) both reactive (Hg^1subR) and nonreactive (Hg^1subNR). The total concentration of mercury hitherto observed amounted to 2-5 $\mu g/m^3$. The water soluble fraction of this total mercury concentration has been found to be 40-80 percent. This means that the content of mercury in coal has probably been released at the combustion process (t>1000 degree C) as Hg degree of which subsequently 40-80 percent have been oxidized to Hg^1 in the stack as the temperature had decreased to below 500 degree C. The water soluble (oxidized) mercury consists of two different types of compounds. One of these has the property to resist reduction with $SnCl_2$ but can be reduced by $NaBH_4$ (Hg^1subNR). Most of Hg in smoke from coal fire belongs to this type. The other type is easily reduced by $SnCl_2$ (Hg^1subR). The chemical composition of these water soluble mercury compounds is not yet established. For Hg^1subNR in smoke from coal fire it has been shown that it is not CH_3HgCl nor sulfite-complexes. For Hg^1subR it has been shown that in alcaline solutions it behaves as if it were $Hg(OH)_2$. Consequently it is possible that Hg^1subR here is composed of a number of Hg^2+-salts with not too strong bonds to the ligands.

50531 **(PB—84-198746) National air quality and emission trends report, 1982.** Hunt, W.F. Jr.; Curran, T.C.; Faoro, R.B.; Frank, N.H.; Mann, C. (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Mar 1984. 141p. (EPA/450/4—84-002). NTIS, PC A07/MF A01.

This report presents national and regional trends in air quality from 1975 through 1982 for total suspended particulate, sulfur dioxide, carbon monoxide, nitrogen dioxide, ozone and lead. Both national and regional trends in each of the major pollutants are examined and, where appropriate, specific Statewide air quality trends. Air quality trends are also presented for both the National Air Monitoring Sites (NAMS) and other site categories. In addition to ambient air quality, trends are also presented for annual nationwide emissions. These emissions are estimated using the best available engineering calculations; the ambient levels presented are averages of direct measurements. This report also includes a section, Air Quality Levels in Standard Metropolitan Statistical Areas (SMSA's). Its purpose is to provide interested members of the air pollution control community, the private sector and the general public with greatly simplified air pollution information. Air quality statistics are presented for each of the pollutants for all SMSA's with populations exceeding 500,000 for the years 1980, 1981 and 1982.

50532 **(PB—84-199660) Investigations into the emissions effects of vehicle misfueling.** Armstrong, J.A. (Environmental Protection Agency, Ann Arbor, MI (USA). Inspection and Maintenance Staff). 2 Apr 1984. 24p. NTIS, PC A02/MF A01.

Presented at the Tenth North American Motor Vehicle Emission Control Conference at New York, New York on April 2, 1984.

The Environmental Protection Agency (EPA) is currently investigating the amount and the frequency of misfueling and its effect on motor vehicle exhaust emissions. This report summarizes four different programs, three of which have been completed and one which is still under way. Included in this report are the effects of tampering on exhaust emissions and on emission control components, the comparison between low and high altitude, the effects of continous misfueling and the frequency of misfueling.

50533 **(PB—84-206515) Review of recent research in indoor air quality. Final report October 1983-February 1984.** Kashdan, E.R.; Sickles, J.E.; Ranade, M.B. (Research Triangle Inst., Research Triangle Park, NC (USA)). May 1984. 183p. (RTI—2784/01-01F). NTIS, PC A09/MF A01.

The report reviews indoor air quality research in an effort to define the state-of-the-art. Several approaches were taken: (1) about 150 recent journal articles, symposium presentations, and bibliographic reports were reviewed and are presented in an annotated bibliography, arranged by subject; (2) about 30 prominent researchers in indoor air quality were contacted, and contacts are summarized; and (3) significant articles (prior to 1980) were reviewed and are listed in a separate unannotated bibliography. The information in the annotated bibliography and contact summaries is summarized. The report briefly discusses the quality and apparent deficiencies of the reviewed data base of articles, reports, and books.

50534 **Copper smelters and atmospheric visibility in the southwest, seasonal analysis.** Nochumson, D.H.; Williams, M.D. (Los Alamos National Lab., NM). *Journal of the Air Pollution Control Association;* **34**: No. 7, 750-752(Jul 1984).

Seasonal results from a study which evaluated the effects of sulfur oxides (SO/sub x/) emitted from 11 copper smelters on atmospheric visibility in 14 national parks and wilderness areas are presented. In addition two alternative strategies for controlling SO/sub x/ are compared. They are supplementary control systems (SCS) and continuous emission controls (CEC). The objective of each strategy is not to improve visibility but is to meet the National Ambient Air Quality Standards for sulfur dioxide (SO_2). SCS is a strategy that has been used by almost all of the 11 copper smelters. It reduces SO/sub x/ emissions during adverse meteorological conditions through production curtailment. SCS has not been successful at eliminating NAAQS violations. The emissions used for the

SCS control alternative are based upon actual copper smelter SO/ sub x/ emissions and operating conditions during 1979. The year 1979 was selected because it is fairly representative of production levels, though highly variable, from 1965 to 1978 and copper smelter SO/sub x/ emissions during the latter half of the 1970s. In more recent years, the copper industry has been economically depressed and copper smelter production and SO/sub x/ emissions have been lower. The southwestern states are implementing the CEC strategy to control SO/sub x/ emissions from copper smelters as part of their state implementation plans. For production levels typical of 1979, the CEC regulations would require about a two-thirds reduction in SO/sub x/ emissions from that allowed under SCS. The study estimates the effect of this reduction upon the improvement of visibility in southwestern national parks and wilderness areas.

50535 **Use of a massive volume air sampler to collect fly ash for biological characterization.** Cheng, Y.S.; Hanson, R.L.; Carpenter, R.L.; Hobbs, C.H. (Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM). *Journal of the Air Pollution Control Association;* **34**: No. 6, 671-674(Jun 1984). Contract AC04-76EV01013.

The report describes the modification of a massive volume air sampler (MVAS) to collect fly ash emissions from the stack mouth of an experimental fluidized bed combustor. High volume filter fly ash samples and laboratory size cascade impactor samples were simultaneously obtained to verify the operation of the MVAS. Due to the large quantity of size-classified fly ash it was possible to characterize its physicochemical and biological properties as a function of particle size. Results show that the bulk density of the FBC fly ash was independent of the particle size. Although the MVAS collects fly ash fractions with considerable overlap, the trend toward higher mutagenic activity in the smaller size fraction noted in previous studies of fly ash was present. As the MVAS does have a large capacity, relatively large quantities of ash can be collected within reasonable sampling times. With appropriate dilution even hot gas streams can be sampled at near ambient temperatures.

50536 **First estimate of annual mercury flux at the Kilauea main vent.** Siegel, S.M.; Siegel, B.Z. (Hawaii Univ., Honolulu). *Nature (London);* **309**: 146-147(10 May 1984).

Mercury and sulphur dioxide analyses were conducted from 1971 to 1980 on air samples collected immediately downwind of Halemaumau, the Kilauea main vent, in Hawaii. On the basis of these measurements, an Hg/SO2 ratio of 0.00051 has been derived which, when applied to the recently determined SO2 mass output of Halemaumau, yields a calculated Hg flux of 2.6 x 10 to the 8th g annually. This rate is consistent with Varekamp and Busek's (1981) evidence suggesting that volcanogenic Hg significantly contributes to the atmospheric total. 20 references.

50537 **Comments on acid rain.** Perhac, R.M. pp 77-93 of Research report to American Electric Power Service Corporation on position statements by other concerned organizations. Appendix A. Columbus, OH; Battelle Columbus Laboratories (1980).

The EPRI research program on acid rain is discussed historically and philosophically. Principal goals seek to determine the actual ecosystem impacts plus to delineate what portion of the problem is attributable to electric utilities. Research seeks the answers by studying: the magnitude of ecological damage; the geographic extent of acid rain; the efficacy of long-range transport; and the atmospheric chemistry of acid rain formation. 8 references, 18 figures.

50538 **Direct formation of NO_2 in combustion products.** McLean, W.J.; Chen, J.Y.; Gouldin, F.C.; Oven, M.J. (Sandia Labs., Livermore, CA). *Studies in Environmental Science;* **8**: 173-180(1980). (CONF-820526—).

From 15. international colloquium on polluted atmospheres; Paris, France (4 May 1982).

It is noted that combustion devices may, under some operating conditions, produce NO/sub x/ emissions containing a rather large fraction of NO_2. A detailed chemical kinetic mechanism for such NO_2 formation is presented, and the results of measurements on a laboratory combustor are described. It is concluded that NO_2 forms via the reaction $NO + HO_2 \Sigma NO_2 + OH$ in regions where combustion processes are rapidly quenched by mixing with excess air.

5003 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 50030049565, 49870, 49874, 50527

50539 **(DOE/EML—431) Semi-annual report of the Department of Energy, Operational Safety, Health and Environment Division - Quality Assessment Program.** Sanderson, C.G.; Feiner, M.S. (USDOE Environmental Measurements Lab., New York). 1 Sep 1984. 57p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85002011.

The results of radiochemical analysis performed on the Quality Assessment Program (QAP) test samples received on or before August 10, 1984 are presented. This report reviews the results submitted by 25 participating laboratories. (ACR)

50540 **(NUREG/CR—4007) Lower limit of detection: definition and elaboration of a proposed position for radiological effluent and environmental measurements.** Currie, L.A. (National Bureau of Standards, Washington, DC (USA)). Sep 1984. 151p. NTIS, PC A08/MF A01 - GPO* $5.50. File Number TI85900256.

A manual is provided to define and illustrate a proposed use of the Lower Limit of Detection (LLD) for Radiological Effluent and Environmental Measurements. The manual contains a review of information regarding LLD practices gained from site visits; a review of the literature and a summary of basic principles underlying the concept of detection in Nuclear and Analyticai Chemistry; a detailed presentation of the application of LLD principles to a range of problem categories (simple counting to multinuclide spectroscopy), including derivations, equations, and numerical examples; and a brief examination of related issues such as reference samples, numerical quality control, and instrumental limitations. An appendix contains a summary of notation and terminology, a bibliography, and worked-out examples. 100 references, 10 figures, 7 tables.

50541 **(OEFZS—4187) Uranium content in surface air in Vienna during the years 1963/64 and 1974 - 1978.** Irlweck, K.; Pichlmayer, F. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). Nov 1982. 14p. (In German). (ST—103/82; PH—351/82). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703133.

Air filters collected at a sampling station in Vienna (Hohe Warte) have been analyzed for their uranium content by means of alpha spectrometry. On these filters of the type Whatman 501 the aerosol was deposited over a period of 24 hours using an air flow rate of 100 l/min. Average values for two or three months were achieved taking 20 - 40 filters with a total air volume of 2000 - 8000 m^3 for analysis. Such average air concentrations for uranium (^{238}U) were in the range between 10 - 110 aCi/m^3 or 30 - 330 pg U(nat)/m^3. During the period 1974 - 1978 a mean value of 33.5+- 14.3 aCi/m^3 (102 +- 43 pg/m^3) was found. Related to the mean dust concentration of this period, the uranium content of the ashed aerosol samples was about 4 ppm. Although the alpha spectrometric results showed a small increase in the isotopic composition for ^{234}U especially during the springtime there was no hint for fallout particles caused by ^{235}U fission bombs from mass spectrometric investigation of these samples. Besides resuspension of soil materials, emission from coal fired stationary sources (Hausbrand) in crowded urban areas were discussed as possible sources of the uranium concentrations found in the surface air.

50542 **(PNL-SA—11669) MESOI, an interactive atmospheric dispersion model for emergency response applications.** Ramsdell, J.V.; Athey, G.F.; Glantz, C.S. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1983. Contract AC06-76RL01830. 8p. (CONF-840202—27). NTIS, PC A02/MF A01; GPO Dep. File Number DE85000361.

From 17. midyear topical meeting of the Health Physics Society; Pasco, WA, USA (5 Feb 1984).

MESOI is an interactive atmospheric despersion model that has been developed for use by the US Department of Energy, and

the US Nuclear Regulatory Commission in responding to emergencies at nuclear facilities. MESOI uses both straight-line Gaussian plume and Lagrangian trajectory Gaussian puff models to estimate time-integrated ground-level air and surface concentrations. Puff trajectories are determined from temporally and spatially varying horizontal wind fields that are defined in 3 dimensions. Other processes treated in MESOI include dry deposition, wet deposition and radioactive decay. 9 references.

50543 **(ZfK—514) NIDAC - an on-line program for measurement and anlysis of gamma-ray emitting samples for environmental surveillance.** Sahre, P.; Knobus, B.; Fietz, J. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Dec 1983. 19p. (In German). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703143.

For the quantitative nuclide analysis of γ-ray emitting samples measured with semiconductor detectors and evaluated by means of the NTA 1024 Hungarian multichannel analyzer on-line connected with the EMG 666 desk computer the program NIDAC has been developed. Measurement and analysis of spectra are carried out on-line and in a dialogue mode. The program is to rationalize the work in environmental surveillance. Therefore, the program determines nuclides and activities as well as derives data like specific activities etc. needed for reporting. A plot of results is available after the end of measurement within 2 minutes, at maximum.

5005 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 50050049554, 49757

5006 Regulations

REFER ALSO TO CITATION(S) 50060050531

50544 **Acid rain control (Part 2). Hearings before the Subcommittee on Health and the Environment of the Committee on Energy and Commerce, House of Representatives, Ninety-Eighth Congress, Second Session on H.R. 3400, February 17 and March 5, 1984.** Washington, DC, USA; Government Printing Office (1984). 837p.

Part 2 of the hearing record covers two days of hearings in Cleveland and Chicago, with testimony from representatives of industry, labor, electric utilities, environmental groups, research groups, and public officials on the merits of a legislative proposal to reduce the levels of sulfur dioxides and nitrogen oxides in the air. At issue was how to allocate the costs of air pollution control; i.e., how to protect the environment without jeopardizing Midwestern jobs. H.R. 3400 amends the Clean Air Act and attempts to reconcile these conflicting goals without setting one region of the country against another. Its proponents urged its passage as energy policy with a national rather than regional character. Material submitted for the record follows the testimony of 32 witnesses.

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

5101 Basic Studies

50545 **(CONF-8405237—1) Effects of prescribed fire on water quality at the Santee Experimental Watersheds in South Carolina.** Richter, D.D.; Ralston, C.W.; Harms, W.R.; Gilliam, F.S. (Oak Ridge National Lab., TN (USA); Duke Univ., Durham, NC (USA). School of Forestry and Environmental Studies; Forest Service, Charleston, SC (USA). Forestry Sciences Lab.; Kansas State Univ., Manhattan (USA). Div. of Biology). 1984. Contract AC05-84OR21400. 19p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001865.

From Southern regional meeting of National Council of the Paper Industry for air and stream improvement; Atlanta, GA, USA (30 May 1984).

Environmental Sciences Div. Publication No. 2379.

Prescribed fire is an important practice in the multiresource management of forests, and controlled burning is now applied annually to about 1 million hectares (2.4 million acres) of forest in the southeastern United States. Prescribed fires had few detectable effects on forest soils, nutrient cycling, and hydrologic systems of a pine-flatwoods watershed at the Santee Experimental Forest in the Francis Marion National Forest in South Carolina, a site of long-term watershed research by the US Forest Service and Duke University. Experiments were designed so that treatment effects would simulate responses of an operational southern pine forest, and it was concluded that nutrient fluxes from burned pine litter to ground and stream waters are not likely to have appreciable effects on the quality of waters that drain southern pine watersheds, especially those with fine-textured soils. 15 references, 4 figures, 1 table.

50546 **(CONF-8406204—1) Bird communities and vegetation structure in pine plantations of the southeastern Costal Plain.** Kroodsma, R.L. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 13p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001243.

From Workshop on management of nongame species and ecological communities; Lexington, KY, USA (11 Jun 1984).

Breeding birds and vegetation structure were studied in 11 pine plantations and 2 scrub oak plots on the Savannah River Plant near Aiken, South Carolina. In the pine plantations, bird density and species number were significantly correlated ($P < 0.05$) with the density of broad-leaved vegetation, most of which occurred in the understory. Birds that nested on or near the ground were responsible for this correlation. Significant differences ($P < 0.05$) in birds were found among the 3 species of pines used in the plantations. The pine species, in decreasing order of bird density and species number, were loblolly (Pinus taeda), slash (P. elliotti), and longleaf (P. palustris). Bird populations were low in the scrub oak plots. 23 references, 5 tables.

50547 **(CONF-8406209—1) Simulating responses to expected climate change in eastern North America: applications to decision-making in the forest industry.** Solomon, A.M.; West, D.C. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 35p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85001272.

From EPA/SAF/NFPA conservation foundation workshop on effects of CO/sub 2/ increases on the forest industry; Boulder, CO, USA (25 Jun 1984).

The effects of rising CO_2 on climate are debatable. However, even if the climate change projections from general circulation models of the atmosphere are proven correct, responses by forests on specific small tracts of land are not intuitively obvious. Standard regression techniques may be misleading or invalid for predictions of future structural or compositional responses; the ecological systems are simply too complex, and combinations of future climatic variables are too different from those of today. Instead, the problem may be soluble with a modeling approach that can be based upon documented differences in response by individual tree species to separate and combined environmental variables. We present one such approach that has been under development for several years at Oak Ridge National Laboratory (ORNL) and elsewhere. We show how the individual natural histories of tree species (warmth and moisture requirements, shade and root-competition tolerance, regeneration and mortality characteristics) can be interfaced with intra-annual variations and shifting long-term means in climate variables. The resulting model can project long-term forest ecosystem behavior under expected future conditions that may be quite different from those found on the modern landscape. We then illustrate use of the model by applying it to land transaction decisions in which long-term considerations are required. 72 references, 5 figures, 1 table.

50548 **(CONF-8408111—1) Comparison of tree growth models.** Dale, V.H.; Doyle, T.W.; Shugart, H.H. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 33p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85001761.

From ISEM symposium on mathematics of plant growth form modeling at AIBS meeting; Fort Collins, CO, USA (8 Aug 1984).

Tree growth models project the growth and development of forest ecosystems by increasing the size of each simulated tree in the forest on an annual or greater periodic basis. These models are often referred to as tree models because they are based on the birth, growth and death of individual trees. The characteristics of individual trees are aggregated to describe the stand. A wide variety of natural stands and plantations in different locations have been so modeled. The present paper reviews the major categories of tree models and the growth equations used. The underlying assumptions, mathematical forms of the equations and factors that seem to influence which formulations are used in different categories are discussed. The relationships of growth equations to data structures and biological mechanisms are also discussed and compared. 69 references.

50549 **(CONF-8410148—1) What restoration ecology can tell us about mycorrhiza.** Miller, R.M. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000065.

From Restoration ecology: theory and practice; Madison, WI, USA (11 Oct 1984).

Research is summarized on how different topsoil handling procedures influence mycorrhizal propagule survival. The relationship of mycorrhiza to plant establishment and survival is also discussed. (ACR)

50550 **(PNL-SA—10826) Impact of Lupinus leucophyllous on the nitrogen budgets of semi-arid plant communities.** Hinds, W.T.; Hinds, N.R. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1982. Contract AC06-76RL01830. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000374.

In the semi-arid grassland on the Arid Lands Ecology Reserve on the Hanford Site in south-central Washington State, three legume flushes occurred in the past decade. Estimates of leguminous nitrogen in both native and disturbed vegetation after a flush showed that nitrogen in the legume (above-ground) doubled the amount of nitrogen associated with vascular plant tissues. 21 references, 2 tables.

5102 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 51020049407, 50523, 50525, 50570, 50650

50551 **(PB—84-196732) Thermal treatment of municipal sewage sludges.** LeBrun, T.J.; Tortorici, L.D. (Los Angeles County Sanitation Districts, Whittier, CA (USA)). May 1984. 236p. NTIS, PC A11/MF A01.

The thermal conditioning research program was conducted as part of an overall long-term sludge management study for the Los Angeles and Orange County metropolitan areas. The major goal of this portion of the study was to investigate the advantages of thermal conditioning of primary and waste activated sludges prior to anaerobic digestion, on a continuous flow and pilot scale basis. The studies were designed to demonstrate whether thermal conditioning would help produce increased gas production and volatile solids destruction during subsequent anaerobic stabilization of the sludge. Anaerobic digestion and anaerobic filtration were used for sludge stabilization. The effects of thermal conditioning on sludge dewaterability were studied by means of dewatering via a filter press, vacuum filter, scroll and basket centrifuges and belt filter press. Other studies of interest included the fate of pathogens and heavy metals, and the production and control of odors during the thermal conditioning process. The pilot scale thermal conditioning unit was tested using a variety of operational conditions. Operating temperatures and pressures were varied and thermal conditioning with and without the use of oxygen was investigated. Two types of wastewater sludges were used: waste activated sludge and a blend of 65 percent raw primary and 35 percent waste activated sludge. An energy analysis was conducted to determine the net energy demands of including thermal conditioning in the sludge process.

50552 **(PB—84-198621) Soil sampling quality assurance user's guide.** Barth, D.S.; Mason, B.J. (Nevada Univ., Las Vegas (USA)). May 1984. 113p. NTIS, PC A06/MF A01.

The inherent inseparability of a cost-effective Soil Sampling Quality Assurance/Quality Control (QA/QC) Plan from the objectives of a soil monitoring program is emphasized. Required precisions and confidence levels for the data cannot be defined until the decisions which will be made on the basis of the data are clearly stated and the consequences of making Type I (false positive) or Type II (false negative) errors are weighed. Statistical considerations are presented with special attention to analyses of variance of soil monitoring data, methods of calculating required numbers of soil samples to achieve desired precisions and confidence levels, possible applications of Kriging, and assignment of control limits to QA/QC data. The value of an exploratory or preliminary study to the cost-effective achievement of both the soil monitoring objectives and the objectives of the Soil Sampling QA/QC Plan is strongly emphasized. The value of developing a hypothetical model to estimate the distribution in space and time of soil pollutants and thus to assist in the design of the monitoring network is discussed. Methods for determination of the number and locations of soil sampling sites; sample collection methods and procedures to include frequency of sampling; sample handling to include labeling, preservation, preparation for analysis, and transport; together with QA/QC aspects are presented and discussed. Finally, the importance of systems audits and training to the achievement of soil sampling QA/QC objectives is presented and discussed.

50553 **(PB—84-212752) Vadose zone monitoring for hazardous waste sites.** Everett, L.G.; Wilson, L.G.; Hoylman, E.W. (Kaman Tempo, Santa Barbara, CA (USA)). Oct 1983. 379p. NTIS, PC A17/MF A01.

This book describes the applicability of vadose zone monitoring techniques to hazardous waste site investigations. More than 70 different sampling and nonsampling vadose zone monitoring techniques are described in terms of their advantages and disadvantages. Physical, chemical, geologic, topographic, geohydrologic, and climatic constraints for vadose zone monitoring are quantitatively determined. Vadose zone monitoring techniques are categorized for premonitoring, active, and postclosure site assessments. Waste disposal methods are categorized for piles, landfills, impoundments, and land treatment. Conceptual vadose zone monitoring approaches are developed for specific waste disposal method categories.

50554 **(UBA-FB—82-162) Development of numerical simulation models for vertical solute transport in unsaturated soils and unconsolidated sediments.** Duynisveld, W.H.M. (Umweltbundesamt, Berlin (Germany, F.R.); Bundesanstalt fuer Geowissenschaften und Rohstoffe, Hannover (Germany, F.R.)). 1983. 197p. (In German). Umweltbundesamt, Berlin (Germany, F.R.).

The theory and the numerical simulation of the vertical movement of water and solute in the unsaturated soil in the field are discussed. Firstly, a simulation model is described with which the vertical movement of water can be calculated, taking into account the uptake of water by roots. A newly developed method of calculation permits time-depth curves of water movement to be plotted and the residence time of water in the unsaturated soil to be determined. Next, the transport of solute under steady-state and transient water flow conditions is dealt with; it is simulated using finite difference models. The influence of adsorption processes and uptake of nutrients by roots on the movement of solute is considered and their simulation using numerical models is described.

50555 **Microcosm as a tool for estimation of environmental transport of toxic materials.** Draggan, S. (Oak Ridge National Lab., TN). *International Journal of Environmental Studies;* **10**: 65-70(1976).

Increases in toxic chemical dissipation makes their control in the environment desirable. Environmental control of these substances requires thorough understanding of the functioning of ecosystems potentially receiving chemical input, and of the behavior and fate of released chemicals. Terrestrial microcosms are useful tools in chemical fate studies; however, critical assessment of their

ability to simulate ecosystem processes has been limited. This paper provides a rationale for evaluating the utility of microcosms for prediction of chemical fate in natural ecosystems.

5103 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 51030049566, 49567, 49828, 49829, 49830, 49831, 49870, 50539, 50543

50556 **(CONF-8410147—1) Activity ratios of thorium daughters in vivo.** Toohey, R.E.; Rundo, J.; Sha, J.Y.; Essling, M.A.; Pedersen, J.C.; Slane, J.M. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 14p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000100.

From Radiobiology of radium and thorotrast conference; Neuherberg, F.R. Germany (29 Oct 1984).

A computerized method of least squares has been used to analyze the ^{228}Ac and ^{212}Pb-^{212}Bi and daughter γ-ray spectra obtained in vivo from 133 former workers at a thorium refinery. In addition, the exhalation rate of ^{220}Rn was determined for each subject and expressed as pCi of emanating ^{224}Ra. This value was added to the ^{212}Pb value determined from the γ-ray measurements to obtain the total ^{224}Ra present, and the ratio of ^{224}Ra to ^{228}Ac was calculated. Values of the ratio ranged from 0.52 +- 0.32 to 2.1 +- 1.7, with a weighted mean of 0.92 +- 0.17. However, it appears that the ratio observed in a given case is characteristic for that case alone; the computed mean value may not be meaningful. The least squares fitting procedure and the overall calibration of the counting system were validated by measurements of ^{224}Ra in the lungs of one subject postmortem, compared with results obtained from the same subject in vivo. 6 references, 5 figures.

50557 **(DOE/EML—429) Strontium-90 in the US diet, 1982.** Klusek, C.S. (USDOE Environmental Measurements Lab., New York). Jul 1984. 48p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85002012.

Estimates of ^{90}Sr intake via the total diet in New York City and San Francisco have been made since 1960 from quarterly food samplings and average consumption statistics. The dietary intake of ^{90}Sr has decreased from the maximum levels attained during 1963 to 1964, but the decline has become more gradual in recent years due to the continuing small amounts of ^{90}Sr deposition and the little-changing cumulative deposit of ^{90}Sr in soil. The annual intake in 1982 averaged 5.4 pCi/day (0.20 Bq/day) in New York, and 2.6 pCi/day (0.096 Bq/day) in San Francisco, little changed from the previous year. Further gradual reductions in ^{90}Sr intake are anticipated during 1983. 11 references, 7 figures, 4 tables.

50558 (INIS-mf—9052, pp 29) **Gamma-ray emitting radionuclides in environmental samples from the South-West Bulgaria.** Shekherov, L.; Prodanov, D.; Delcheva, D.; Stefanov, G. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). 1983. (In Bulgarian). NTIS (US Sales Only), PC A99/MF A01. File Number TI84780548. (CONF-8309253—Absts.).

From 1. national congress of the physicists in Bulgaria; Sofia, Bulgaria (28 Sep 1983).

Published in summary form only.

50559 (INIS-mf—9052, pp 30) **Joint comparative research on gamma-ray emitting radionuclides in samples from the Danube-Black Sea territorial complex.** Shekherov, L.; Prodanov, J.; Delcheva, D.; Stefanov, G. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). 1983. (In Bulgarian). NTIS (US Sales Only), PC A99/MF A01. File Number TI84780548. (CONF-8309253—Absts.).

From 1. national congress of the physicists in Bulgaria; Sofia, Bulgaria (28 Sep 1983).

Published in summary form only.

50560 **(ISH—28) Studies on the 'air-grass-cow-milk' exposure pathway of airborne ^{131}I from Wuergassen nuclear power plant in the 1980 grazing season.** Haubelt, R.; Burkhardt, J. (Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahlenhygiene). Dec 1983. 126p. (In German). Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahlenhygiene.

The measurements and statistics, which were much more detailed than the annual routine measurements, included ^{131}I emission measurements on the stack, the registration of meteorological parameters, measurements of ^{131}I concentrations in air, grass, and milk, and supplementary statistics on the farmers' animal keeping habits. The infant thyroid dose resulting from ^{131}I in milk was found to be lower by at least one order of magnitude than the value calculated from the emission data for the point of maximum exposure according to the Guideline to Explain Sect. 45 StrlSchV. This result confirms the results of earlier investigations. The model calculation according to the Guideline yields a value of 30 mrem for incorporation of ^{131}I into the infant thyroid via the ingestion pathway for the year 1980, i.e. 25 times the measured value. The possible reasons for this are discussed.

50561 **(PNL-SA—12152) Comparing computing formulas for estimating concentration ratios.** Gilbert, R.O.; Simpson, J.C. (Pacific Northwest Lab., Richland, WA (USA)). Mar 1984. Contract AC06-76RL01830. 54p. (CONF-841142—1). NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE84008644.

From Symposium on environmental research for actinide elements; Hilton Head Island, SC, USA (7 Nov 1984).

This paper provides guidance on the choice of computing formulas (estimators) for estimating concentration ratios and other ratio-type measures of radionuclides and other environmental contaminant transfers between ecosystem components. Mathematical expressions for the expected value of three commonly used estimators (arithmetic mean of ratios, geometric mean of ratios, and the ratio of means) are obtained when the multivariate lognormal distribution is assumed. These expressions are used to explain why these estimators will not in general give the same estimate of the average concentration ratio. They illustrate that the magnitude of the discrepancies depends on the magnitude of measurement biases, and on the variances and correlations associated with spatial heterogeneity and measurement errors. This paper also reports on a computer simulation study that compares the accuracy of eight computing formulas for estimating a ratio relationship that is constant over time and/or space. Statistical models appropriate for both controlled spiking experiments and observational field studies for either normal or lognormal distributions are considered. 24 references, 15 figures, 7 tables.

5105 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 51050049605

50562 **(N—84-20913) Arctic Terrestrial Environmental Research Programs of the Office of Energy Research, Department of Energy: Evaluations and recommendations. Appendix B: Components of an Arctic Terrestrial Environmental Research Program.** (National Academy of Sciences - National Research Council, Washington, DC (USA)). 1983. 30p. (PB—84-129766). NTIS, PC A03/MF A01.

A research plan, research priorities, possible sites for research, and criteria for site selection are suggested for long term studies of the environmental effects of energy-related development in the terrestrial Arctic region. The impact of and recovery from disturbances to riparian ecosystems, slopes, drainage patterns, air quality, and vegetation are of prime interest.

52 ENVIRONMENTAL SCIENCES, AQUATIC

5201 Basic Studies

REFER ALSO TO CITATION(S) 52010050515, 50516, 50517

50563 (CONF-8209256—1) Striped bass, temperature, and eutrophication: a speculative hypothesis for environmental risk. Coutant, C.C. (Oak Ridge National Lab., TN (USA)). 1982. Contract AC05-84OR21400. 98p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE84017329.

From American Fisheries Society annual meeting on striped bass: environmental risk in fresh and salt water; Hilton Head, SC, USA (1 Sep 1982).

The paradoxical record of striped bass distribution and abundance, including population declines in coastal waters and variable success of freshwater introductions, is analyzed for consistency with a thermal niche-dissolved oxygen-squeeze hypothesis. A commonality among diverse field and laboratory observations supports a genetic-based thermal niche for the species that changes to lower temperatures as fish age. This shift can cause local conditions, especially warm surface strata and deoxygenated deep water, to be incompatible with the success of large fish. Crowding due to temperature preferences and avoidance of low oxygen concentrations can lead to pathological symptoms and over fishing, which may contribute to population declines. Through a mixture of evidence and conjecture, the thermal niche-dissolved oxygen hypothesis is proposed as a unified perspective of the habitat requirements of the species that can aid in its study and management. 141 references, 13 figures.

50564 (CONF-8310318—1) Size distribution of planktonic autotrophy and microheterotrophy in DeGray Reservoir, Arkansas. Kimmel, B.L.; Groeger, A.W. (Oak Ridge National Lab., TN (USA)). 1983. Contract AC05-84OR21400. 30p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85000923.

From DeGray lake research symposium; Arkadelphia, AR, USA (4 Oct 1983).

Naturally occurring assemblages of phytoplankton and bacterioplankton were radiolabelled with sodium ^{14}C-bicarbonate and sodium ^{3}H-acetate and size fractionated to determine the size structure of planktonic autotrophy and microheterotrophy in DeGray Reservoir, an oligotrophic impoundment of the Caddo River in south-central Arkansas. Size distributions of autotrophy and microheterotrophy were remarkably uniform seasonally, vertically within the water column, and along the longitudinal axis of the reservoir despite significant changes in environmental conditions. Planktonic autotrophy was dominated by small algal cells with usually >50% of the photosynthetic carbon uptake accounted for by organisms <8.0 μm. Microheterotrophic activity in the 0.2- to 1.0-μm size fraction, presumably associated with free-living bacterioplankton not attached to suspended particles, usually accounted for >75% of the planktonic microheterotrophy. Longitudinal patterns in autotrophic and microheterotrophic activities associated with >3-μm and >1-μm size fractions, respectively, suggest an uplake to downlake shift from riverine to lacustrine environmental influences within the reservoir. 83 references, 7 figures.

50565 Temporal and spatial variability of phytoplankton in a subtropical ecosystem. Bienfang, P.K.; Szyper, J.P.; Okamoto, M.P.; Noda, E.K. (Oceanic Inst., Waimanalo, HI). *Limnology and Oceanography;* **29**: No. 3, 527-539(May 1984).

Phytoplankton conditions were examined at two stations off the leeward coast of Oahu, Hawaii. Significant temporal variability was observed in the chlorophyll and pheopigment data. Significant temporal and spatial variability was observed in the ATP and productivity data. Dissimilar inflection depths for nitrate, phosphate, and silicate indicate nitrate availability and phosphate limitation in the lower photic zone. Production between January and May was 11 times that between May and November; productivity below 44 m accounted for most of this variation. Biological and physical analyses indicate that variations in vertical nutrient supply, related to differences in current shear, caused this temporal variaton.

5202 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 52020049427, 49462, 49463, 49464, 49465, 50523, 50525, 50545, 50553, 50555, 50580, 50598, 50650

50566 (BNL—35124) Virus entrainment in a glacial aquifer. Vaughn, J.M.; Landry, E.F.; Chen, Y.S.; Thomas, M.Z. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 18p. (CONF-8404192—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85001344.

From Conference on progress in chemical disinfection: problems at the frontier; Binghamton, NY, USA (13 Apr 1984).

Entrainment of naturally-occurring human viruses from a subsurface disposal system through a shallow aquifer (Upper Glacial) was investigated. Viruses were recovered at down-gradient distances of 220 ft and from depths as great as 60 ft. A negative correlation ($p < 0.05$) was noted between virus isolation frequency and increasing distance from the leaching pools. Product-moment correlation analysis of data indicated no relationship between virus occurrence and several water quality indicators including: total or fecal coliforms; pH and conductivity. 17 references, 1 figure, 4 tables.

50567 (CONF-841198—1) Thalweg disposal: demonstration of an alternative. Baker, R.M.; McCown, D.L.; Paddock, R.A.; Ditmars, J.D. (Corps of Engineers, Rock Island, IL (USA); Argonne National Lab., IL (USA)). Aug 1984. Contract W-31-109-ENG-38. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84015843.

From ASCE dredging conference; Clearwater, FL, USA (14 Nov 1984).

Disposal of dredged material in the main channel, or thalweg, is an alternative disposal option for maintenance dredging. The material dredged from the Upper Mississippi River is clean sand and water quality is not a primary concern with regard to thalweg disposal. Modifications of channel morphology and, more importantly, of riverine habitats due to thalweg disposal are the major environmental issues raised. The Rock Island District, Corps of Engineers, is addressing these issues by means of thalweg disposal experiments at three sites on the Upper Mississippi River. In these experiments, dredged sand has been tagged with dyed sand prior to disposal in the thalweg. Monitoring of dyed sand in the bottom sediments in and downstream of the disposal areas at two sites (for periods of 1 and 2 years) has indicated that the dredged sand remains in the thalweg without apparent modification of channel border habitats. 7 references, 5 figures.

50568 (CONF-8409146—1) Chemistry and fate of disinfection by-products. Jolley, R.L. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001109.

From 57. annual conference of the Water Pollution Control Federation; New Orleans, LA, USA (30 Sep 1984).

The chemistry and nature of the reaction products formed during the disinfection of wastewaters with chlorine are discussed in this review paper. 23 references. (ACR)

50569 (GKSS—83/E/67) Development and application of an iridium tracer for tracking tailings in the central Red Sea. Schnier, C.; Fanger, H.U. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1983. 17p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84751519.

In order to investigate the distribution of dIsposed tailings, the element iridium was apphked as a tracer during the prepilot mining test in the Red Sea 1979. In the sediment matrix, Ir can be detected in quantities as small as 25 x 10^{-12} g by means of neutron activation analysis. The tracer was obtained by melting down a mixture of 50 kg quartz and 1 kg IrO_2, then grinding and pulverizing the material to an appropriate grain size distribution. An amount of 480 m^3 tracer-added tailings was disposed in a depth of 400 m close to the Atlantis II deep. Subsequently, in the period 1 month to 2 1/2 years later, 32 sediment samples were taken from the deposition area and analysed for Ir. The Ir concentration ob-

served were surprisingly low and give only vague indications of the spreading of the tailings.

50570 (PB—84-182989) Waste disposal sites and their effect on the quality of ground water: a study of literature. Kooper, W.F. (Rijksinstituut voor Drinkwatervoorziening, The Hague (Netherlands)). 1983. 103p. (In Dutch). NTIS, PC E06/MF E01.

This review addresses the chemical composition of landfill leachate, especially with respect to heavy metals and organic compounds, which strongly depends on the character of the microbiological processes within the landfill. During the anaerobic methanogenic stage of the landfill, the potential groundwater pollution is reduced, compared with the organic-acid forming stage. The time between disposal of waste and the development of the methanogenic phase may last 0.5 to 7 years or even longer. The factors, mentioned in the literature, affecting the process of methane fermentation within the landfill, are sometimes contradictory. This possibly can be ascribed to the fact that the different anaerobic stages can take place simultaneously, due to the heterogeneous composition of the waste. This implies that results from column-experiments can not always be simply translated to field conditions.

50571 (PB—84-194091) EADS (Environmental Assessment Data Systems) Liquid Effluents Data System, 1982. Annual report. Reider, J.P. (Midwest Research Inst., Kansas City, MO (USA)). May 1984. 38p. NTIS, PC A03/MF A01.

The report is the first data summary of wastewater sampling and analysis results compiled in EPA's Liquid Effluents Data System (LEDS). LEDS is a component of a group of related computerized data bases -- Environmental Assessment Data Systems (EADS) -- that describe multimedia discharges from energy systems and industrial processes. EADS was designed to aid researchers in environmental assessment, source characterization, and control technology development. The report summarizes data compiled from implementation of LEDS in 1980 through 1982. It lists sources reported in LEDS, feed materials used, chemical analysis data on hazardous and priority pollutants, and the number of samples for each source.

50572 (PB—84-194604) Removal of polynuclear aromatic hydrocarbons from primary aluminum air pollution control scrubber wastewater. Dempsey, C.R.; Dostal, K.A.; Osantowski, R.A. (Rexnord, Inc., Milwaukee, WI (USA). EnviroEnergy Technology Center). May 1984. 20p. NTIS, PC A02/MF A01.

A pilot-scale study was conducted at a primary aluminum plant to evaluate the removal of benzo(a)pyrene and other polynuclear aromatic hydrocarbons (PAH's) from potline scrubber wastewater. Specific objectives included determining the need for granular activated carbon to remove the PAH's to 10 micrograms/l and evaluating the use of benzo(a)pyrene as an indicator for the removal of all PAH's.

50573 (PB—84-198639) Geothermal environmental impact assessment: an approach to ground water impacts from development, conversion, and waste disposal. Hess, J.W.; Wheatcraft, S.W.; Edkins, J.E.; Jacobson, R.L.; Zimmerman, D.E. (Nevada Univ., Las Vegas (USA). Water Resources Center). Jun 1984. 291p. NTIS, PC A13/MF A01.

Groundwater monitoring for the impacts of geothermal energy development, conversion and waste disposal is similar to groundwater monitoring for other purposes except that additional information is needed concerning the geothermal reservoir. The research described here developed a six-step methodology including failure analysis and computer-based contaminant transport and geochemical models to design groundwater monitoring plans. Failure data analyses indicate that production and injection wells have the highest probability of failure and should be the focal points for groundwater monitoring. Groundwater monitoring techniques fall into four categories: (1) monitoring the injection/production well, (2) monitoring in the saturated zone, (3) monitoring in the unsaturated zone, and (4) monitoring on or above the ground surface. Location of the monitoring wells and what to measure in them may be determined with the aid of computer contaminant transport and geochemical models. POLLUTE is a nondispersing contaminant transport groundwater computer model that enables the user to locate a contaminant plume at a given time. Prediction of resultant fluid chemistries from a leaked geothermal fluid may be essential to unambiguous evaluation of geothermal fluid impact at remote groundwater monitoring sites.

50574 Peroxyacetyl nitrate solubility and decomposition rate in acidic water. Holdren, M.W.; Spicer, C.W.; Hales, J.M. (Battelle Columbus Laboratories, OH). *Atmospheric Environment;* **18**: No. 6, 1171-1173(Jun 1984).

Recent investigations have shown that peroxyacetyl nitrate (PAN) is soluble in acidic water samples. A Henry's law constant of 5 +/- 1 M atm $^{-1}$ has been determined. PAN decays in a first order manner in these solutions, with K = 7.0 +/- 0.3 x 10^{-3} min^{-1} at 5°C. The principal anionic product was nitrate ion.

50575 Feasibility of using fiber optics for monitoring groundwater contaminants. Hirschfeld, T.; Deaton, T.; Milanovich, F.; Klainer, S. (Lawrence Livermore National Lab., CA). *Optical Engineering;* **22**: No. 5, 527-531(Sep-Oct 1983). Contract W-7405-ENG-48.

The use of remote analysis techniques over optical fibers for underground water sampling is considerably less expensive (and offers faster and more complete analysis) than the conventional borehole fields containing sampling devices. The technology is based on fluorometric analysis, combining long range communication fiber optics, laser excitation, and Raman spectroscopic measurement technology. Detection at up to 1000 m range of ppb quantities of fluorescent dye tracers, and ppm quantities of heat and radiation stable tracers, with ~1% qualitative accuracy, has been accomplished. For nonfluorescent compounds, or for mixtures too complex for the intrinsic selectivity of fluorescence, specific compound optrodes (by analogy to electrodes) are used at the fiber tip. These contain immobilized reagents which become fluorescent or whose fluorescence is altered by the sample) reversibly for continuous measurements or irreversibly for cumulative ones).

5203 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 52030049526, 49527, 49528, 49529, 49530, 49531, 49533, 49566, 49848, 49870, 50539, 50543, 50558, 50559, 50561, 50657, 50668

50576 (EPA—520/5-83-027) Methods and results of EPA's study of radon in drinking water. Horton, T.R. (Environmental Protection Agency, Montgomery, AL (USA). Eastern Environmental Radiation Facility). Dec 1983. 31p. NTIS, PC A03/MF A01. File Number TI84901258.

Samples from more than 2500 public water supplies representing 35 states were collected. For the most part, samples were from public groundwater supplies serving 1000 or more people. The arithmetic means for radon, Ra-226, and total uranium were calculated to be 340 pCi/1, 1.6 pCi/1, and 5.1 pCi/1, respectively. The corresponding geometric means for radon, Ra-226, and total uranium were found to be 100 pCi/1, 0.6 pCi/1, and 1.9 pCi/1, respectively. The arithmetic mean for the U-234/U-238 ratio was determined to be 1.8 for higher activity samples (total uranium exceeded 3.5 pCi/1), while the corresponding geometric mean was 1.7. In most cases, total uranium activity determined by the fluorometric method will not be significantly underestimated if a correction factor is applied based on the mean U-234/U-238 ratio for a given geographic region or possibly the entire US. 8 references, 13 figures, 3 tables.

50577 (GESAMP—19) Oceanographic model for the dispersion of wastes disposed of in the deep sea. (International Atomic Energy Agency, Vienna (Austria)). Jun 1983. 182p. NTIS (US Sales Only), PC A09/MF A01. File Number DE84703130.

The report presents results of IMO/FAO/UNESCO/WMO/WHO/IAEA/UN/UNEP joint group of experts on the scientific aspects of marine pollution (GESAMP) to provide advice on the most suitable oceanographic modelling techniques to be applied to the deep-sea dumping of both radioactive and non-radioactive substances. There are four main parts of the work: the present knowl-

edge of oceanic processes that may transfer substances from a deep-sea dump site back to man or his food chain, methods and models presently available for estimating or calculating concentration distributions of contaminants arising from releases from deep-sea dump sites and recommendations as to the presently most appropriate models, the reliability of the concentration distributions obtained using these models and recommended areas for further improvements including research needs.

50578 (INIS-mf—9052, pp 28) **Gamma-spectrometrical measurements in-situ of natural waters in Bulgaria.** Manushev, B.; Mandzhukov, I.; Tsankov, L.; Boshkova, T.; Gurev, V.; Mandzhukova, B.; Kozhukharov, I.; Grozev, G. (Sofia Univ. (Bulgaria). Katedra po Atomna Fizika). 1983. (In Bulgarian). NTIS (US Sales Only), PC A99/MF A01. File Number TI84780548. (CONF-8309253—Absts.).

From 1. national congress of the physicists in Bulgaria; Sofia, Bulgaria (28 Sep 1983).

Published in summary form only.

50579 **(PB—84-194851) Radionuclide removal for small public water systems. Technical report.** (SMC Martin, Inc., Valley Forge, PA (USA)). Jun 1983. 163p. NTIS, PC A08/MF A01.

This document has been prepared to aid water utility owners, engineers, operators and municipal managers in understanding and dealing with excessive radionuclide levels in their water supply. It is intended to be used for defining the problem, developing or evaluating proposed solutions, and explaining to water consumers why radionuclides are controlled and what the approximate cost of control will be. This handbook is designed as a technical guide to radionuclide removal for those smaller size systems that have decided that radionuclide control is desirable. This document contains no regulatory policy and does not obligate systems to use any treatment or nontreatment technique to reduce radionuclide concentrations.

50580 **(PB—84-201607) Feasibility of using fiber optics for monitoring ground water contaminants.** Hirschfeld, T.; Deaton, T.; Milanovich, F.; Klainer, S.M. (Lawrence Livermore National Lab., CA (USA)). Jun 1984. 92p. NTIS, PC A05/MF A01.

Prepared in cooperation with S.T.E. Technical Services, Inc., San Ramon, CA.

The report contains the results of the initial feasibility study for a research program undertaken to develop the technology needed to use fiber optics for monitoring groundwater contaminants. The technology appears especially well suited to the requirements of detection monitoring where a few indicator parameters can be measured continuously by sensors placed down small-diameter monitoring wells. Data are generated at a remote, centrally located fluorimeter, connected to the sampling sites by inexpensive optical fibers. The analytical method is laser-induced fluorescence which gives the desired sensitivity. The optrode, a chemical system and/or a mechanical device at the distal end of a fiber optic, furnishes the needed specificity. Various fiber and optrode configurations have been evaluated and their applications to groundwater monitoring are discussed. Feasibility is shown for physical measurements such as temperature, pressure and pH. Chemical detection and quantification of the actinides, inorganic and organic chlorides, sulfates, alcohols, aldehydes, pesticides and tracer materials are presented. Finally, it is shown that the need for smaller diameter wells (as compared to conventional sampling methods), and the ability to make up to 50 unattended in situ measurements, using a reasonably priced centralized fluorometer system connected to the sampling sites by inexpensive optical fibers, results in acceptable economy.

5205 Site Resource And Use Studies

50581 **(STF—60A82092) Directional wave spectra from the Frigg Field in the North Sea.** Mathiesen, M.; Faanes, T. (SINTEF, Trondheim (Norway)). Oct 1982. 84p. NTIS (US Sales Only), PC A05/MF A01. File Number DE84751651.

At the Frigg field Quarters platform an instrument system capable of providing directional wave information has been operational since June 1980. This report is mainly concerned with the task of establishing the capabilities and limitations of this instrument system. Various directional wave spectrum parameter estimates are computed. The general impression is that the results look quite promising. It is shown that accurate estimates of the mean wave direction are obtained. The instrument system also has clear limitations as no meaningful directional information is obtained for wave frequencies higher than 0.20 Hz. Also, the resolution of the recorded data is relatively poor, resulting in less reliable directional parameter estimates than would otherwise have been obtained. 57 figures, 33 tables.

5206 Regulations

REFER ALSO TO CITATION(S) 52060050579

53 ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

5301 Social And Economic Studies

REFER ALSO TO CITATION(S) 53010049558, 49757, 49926

5302 Assessment Of Energy Technologies

REFER ALSO TO CITATION(S) 53020049371

50582 **(DOE/BP—280) Environmental analysis of Bonneville Power Administration - prescribed audit-based electric energy conservation measures in ten selected industries.** (Seton, Johnson, and Odell, Inc., Portland, OR (USA); Shapiro and Associates, Inc., Seattle, WA (USA); Synergic Resources Corp., Bala-Cynwyd, PA (USA)). Aug 1984. Contract AC79-83BP11279. 247p. NTIS, PC A11/MF A01; 1; GPO Dep. File Number DE85002111.

This document presents an environmental analysis of potential implementation of a variety of BPA-prescribed audit-based electrical energy conservation measures (AEECMs) in ten Pacific Northwest industries. These AEECMs included four categories of generic measures which could be applied in any of the ten industries, as well as a number of individual measures specific to the industries. The generic measures include energy-efficient motors, motor controllers, lighting, and operations and maintenance (O and M) measures. The study examines regional environmental data and federal and state regulations. By profiling representative facilities in the ten industries, existing air, water quality, solid waste, noise, and occupational health characteristics of the ten industries were developed. From these baseline conditions, an environmental analysis of the AEECMs was prepared. These assessments identify how the environmental conditions within the industry are expected to change as a result of implementing the AEECMs, and how adverse effects can be mitigated and at what cost. The assessments also address economic costs of the measures, labor requirements for their installation and maintenance, and the effects of the measures on contaminant concentrations and resultant effects on worker health. 91 references, 10 figures, 6 tables.

50583 **(DOE/EA—0239) Environmental assessment on Bonneville Power Administration's proposed policy for sales of nonfirm energy for service to loads with alternate fuel capability.** (USDOE Bonneville Power Administration, Portland, OR. Office of Power and Resources Management). Aug 1984. 57p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85001138.

Bonneville Power Administration's (BPA) proposed policy to sell nonfirm energy to utilities and direct service industries (DSIs) for service to their loads which have alternate fuel capability formalizes procedures for serving a new market for BPA nonfirm energy. Potential environmental impacts of the policy derive from: (1) changes in the operations of consumers and DSIs served under the policy; (2) changes in the operations of those entities which will experience reduced availability of nonfirm energy; and (3) changes in operation of the Federal Columbia River Power

System (FCRPS) to provide an increased amount of nonfirm energy in order to meet the expanded nonfirm energy market. Effects on FCRPS operations are primarily reflected as impacts on fish, wildlife, and recreation resources. Analysis performed indicates there will be no new operational impacts on these resources. Operating constraints and agreements are in place which will prevent significant harm to anadromous fish from the policy's implementation. BPA intends to take additional actions in the future to protect and enhance anadromous fish. Impacts related to changes in availability of nonfirm to various markets depend on whether a customer class gains or loses access to nonfirm energy and on what the energy is used for. There will be environmental benefits since BPA nonfirm electrical energy will substitute for use of fuels which produce air pollutants and, perhaps, solid waste. Pending public and governmental agency review, it is concluded that implementation of the policy does not significantly affect the quality of the human environment and, therefore, does not require preparation of an environmental impact statement (EIS). 15 references, 4 tables.

50584 **(DOE/EIS—0108D-Vol.1) L-Reactor operation, Savannah River Plant, Aiken, SC. Draft environmental impact statement. Volume 1.** (USDOE Savannah River Operations Office, Aiken, SC). Sep 1983. 352p. NTIS, PC A16/MF A01; 1; GPO Dep. File Number DE85001018.

The purpose of the environmental impact statement is to provide environmental input into the proposed decision to restart L-Reactor at the Savannah River Plant (SRP). The Savannah River Plant is a major US Department of Energy (DOE) installation for the production of nuclear materials for national defense. The L-Reactor operated from 1954 until 1968, when it was placed in standby status due to a decreasing demand for defense nuclear materials. This DEIS assesses the potential environmental effects of the restart of L-Reactor on air and water quality, ecological systems, health risk, archeological resources, endangered species, and wetlands.

50585 **(DOE/EIS—0108D-Vol.2) L-Reactor operation, Savannah River Plant, Aiken, SC. Draft environmental impact statement. Volume 2. Appendices.** (USDOE Savannah River Operations Office, Aiken, SC). Sep 1983. 629p. NTIS, PC A99/MF A01; 1; GPO Dep. File Number DE85001017.

The purpose of the environmental impact statement is to provide environmental input into the proposed decision to restart L-Reactor at the Savannah River Plant (SRP). The Savannah River Plant is a major US Department of Energy (DOE) installation for the production of nuclear materials for national defense. The L-Reactor operated from 1954 until 1968, when it was placed in standby status due to a decreasing demand for defense nuclear materials. This DEIS assesses the potential environmental effects of the restart of L-Reactor on air and water quality, ecological systems, health risk, archeological resources, endangered species, and wetlands. Volume 2 contains appendices on radiation dose calculations, ecology, radiocesium and radiocobalt inventories, archeological and historic resources, hydrology, environmental impacts of postulated accidents, offsite emergency planning, wetlands assessment, SRP reactor safety evaluation, and scoping comments. (ACR)

5303 Environmental Impact Statements

50586 **(NUREG—1026-Final) Final environmental statement related to the operation of Braidwood Station, Units 1 and 2 (Docket Nos. STN 50-456 and STN 50-457).** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Jun 1984. 274p. NTIS, PC A12/MF A01 - GPO* $7.00. File Number TI84901549.

This Final Environmental Statement contains the second assessment of the environmental impact associated with the operation of Braidwood Station, Units 1 and 2, pursuant to the National Environmental Policy Act of 1969 (NEPA) and Title 10 of the Code of Federal Regulations, Part 51, as amended, of the Nuclear Regulatory Commission regulations. This statement examines the environment, environmental consequences and mitigating actions, and environmental and economic benefits and costs. Land use and terrestrial and aquatic ecological impacts will be small. Operational impacts to historic and archeologic sites will be moderate. The effects of routine operations, energy transmission, and periodic maintenance of rights of way and transmission facilities should not jeopardize any populations of endangered or threatened species. No significant impacts are anticipated from normal operational releases of radioactivity. The risk of radiation exposure associated with accidental release of radioactivity is very low. The net socioeconomic effects of the project will be beneficial. On the basis of the analysis and evaluation set forth in this environmental statement, it is concluded that the action called for under NEPA and 10 CFR 51 is the issuance of operating licenses for Braidwood Station, Units 1 and 2. 27 figures, 23 tables.

55 BIOMEDICAL SCIENCES, BASIC STUDIES

5502 Biochemistry

REFER ALSO TO CITATION(S) 5502049606, 50616

50587 **(CONF-8405214—2) Conformations of DNA adducts with polycyclic aromatic carcinogens.** Broyde, S.; Hingerty, B. (New York Univ., NY (USA). Dept. of Biology; Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 20p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001875.

From Molecular basis of cancer conference; Buffalo, NY, USA (29 May 1984).

Minimized semi-empirical potential energy calculations for a number of carcinogen adducts with dCpdG have yielded molecular views of the adduct conformations. The base displaced and Z type conformations of acetylaminofluorene (AAF) adducts to guanine C-8 have been detailed. Model building shows that base displacement causes kinking and denaturation in the B helix, while the Z helix is largely unperturbed by modification with AAF, in agreement with experimental findings. The minor AAF adduct linked to guanine N^2 can reside at a B-Z junction, with the carcinogen buried in a groove in the Z direction, without causing denaturation. The syn guanine in these modified Z forms could be mutagenic, the lesion escaping repair because the helix is undeformed, while the distorted base-displaced conformers are repaired. Aminofluorene (AF) and 4-aminobiphenyl (ABP) linked to guanine N^2 are currently believed to be critical lesions. They all have a pair of A or B type low energy states, one of which has base-base stacking with carcinogen at the helix exterior, and a second with carcinogen-base stacking. The two states are easily interconvertible. It is possible that the carcinogen may reside primarily at the unperturbed helix exterior where it escapes repair, but that carcinogen-base stacking may occur at a critical time during replication, leading to a mutation. 49 references, 8 figures.

50588 **Interpreting the metabolic responses of plants to water stress.** Hanson, A.D. (Michigan State Univ., East Lansing). *HortScience;* 15: No. 5, 623-629(Oct 1980). (CONF-8008179—). Contract AC02-76ER01338.

From 76. annual meeting of the American Society for Horticultural Science; Columbus, OH, USA (1 Aug 1980).

Biological adaptation by-plants to drying (dessication) or drought-prone environments is analyzed. The metabolic components of adaptation and the metabolic symptoms of stress injury are reviewed. Breeding programs for selection of drought-resistance in plants are suggested.

5503 Cytology

REFER ALSO TO CITATION(S) 55030050277, 50617

5504 Genetics

REFER ALSO TO CITATION(S) 55040050646

5505 Metabolism

REFER ALSO TO CITATION(S) 55050049606, 50638

5506 Medicine

REFER ALSO TO CITATION(S) 55060050279, 50626

50589 **(CONF-840798—1) Design and biological properties of iodine-123 labeled β-methyl-branched fatty acids.** Knapp, F.F. Jr.; Goodman, M.M. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 26p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85001291.

From Workshop on radiolabeled free fatty acids; Amsterdam, Netherlands (6 Jul 1984).

The synthetic strategy, synthesis, preclinical evaluation and potential clinical applications of 3-methyl-branched radioiodinated iodophenyl- and iodovinyl-substituted fatty acids are reviewed for use as myocardial imaging agents. 50 references, 6 figures. (ACR)

50590 **(CONF-8409130—2) Ion implantation of surgical Ti-6Al-4V alloy.** Williams, J.M.; Buchanan, R.A. (Oak Ridge National Lab., TN (USA); Alabama Univ., Birmingham (USA)). Sep 1984. Contract AC05-84OR21400. 30p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85000943.

From International conference on surface modification of metals by ion beams; Heidelberg, F.R. Germany (17 Sep 1984).

Ion implantation of N into surgical Ti-6Al-4V alloy dramatically improved the corrosive-wear performance of the alloy. Experiments made use of a special apparatus designed to simulate pertinent chemical and mechanical aspects of the sliding interface between the alloy head and the polyethylene cup of an artificial hip joint and, at the same time, provide an electrochemical measure of wear rate. Profilometer measurements and Rutherford backscattering experiments in conjunction with ion implanted markers were also used to assess wear. All evidence points to a marked improvement in wear rate due to the ion implantation treatment. Samples and wear product were analyzed by ion backscattering of He and H ions. A speculative reason for the improvement is discussed. 21 references, 7 figures.

50591 **(GSF-B—1521) Experimental tumor therapy annual report 1982.** (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.)). Aug 1983. 96p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE84751518.

The present annual report is the fifth in a regular series and documents the continuity of the investigations in the field of experimental tumor therapy. The main points of emphasis of the activities relate above all to problems of dose fractionation and combination treatment. But if the present volume is compared with the previous ones the reader may be struck by the wider range of model systems used, especially of the tumors and normal tissues in which chronic radiation effects are investigated, and also by a concentration on those investigations that are important for solving clinical problems and that make use of many small fractions. Moreover, experiments were carried through in 1982 on the neutron beam set up at the Garching research reactor in order to characterise its biologic effect, which was a preparative measure in view of the planned clinical use.

50592 **(INIS-mf—8798) Mathematical model to determine incorporated quantities of radioactivity from the measured photometric values of tritium-autoradiographs in neuroanatomy.** Jennissen, J.J. (Duesseldorf Univ. (Germany, F.R.). Medizinische Fakultaet). 1981. 61p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE85780002.

The mathematical/empirical model developed in this paper helps to determine the incorporated radioactivity from the measured photometric values and the exposure time T. Possible errors of autoradiography due to the exposure time or the preparation are taken into consideration by the empirical model. It is shown that the error of appr. 400% appearing in the sole comparison of the measured photometric values can be corrected. The model is valid for neuroanatomy as optical nerves, i.e. neuroanatomical materials, were used to develop it. Its application also to the other sections of the central nervous system seems to be justified due to the reduction of errors thus achieved.

50593 **(INIS-mf—9067) 22. Annual congress - The South African Society of Pathologists; The International Academy of Pathology; The Southern African Society of Haematology; The South African Association of Clinical Biochemists. Programme.** (South African Society of Pathologists). 1982. 190p. (CONF-8207112—Summs.). NTIS (US Sales Only), PC A09/MF A01. File Number DE85780058.

From 22. annual congress of the South African Society of Pathologists; Stellenbosch, South Africa (5 Jul 1982).

Separate abstracts have been prepared for items within the scope of the Energy Data Base.

50594 **(LBL—16840) Biology and Medicine Division annual report, 1982-1983.** (Lawrence Berkeley Lab., CA (USA)). Apr 1984. Contract AC03-76SF00098. 215p. NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE84010489.

This annual report presents brief summaries of research activities during 1982 to 1983. Program activities have been individually entered into EDB. They include research medicine, radiosurgery, environmental physiology, radiation biophysics, and structural biophysics. (ACR)

50595 **Radiohalogen-labeled imaging agents. 3. Compounds for measurement of brain blood flow by emission tomography.** Sargent, T.; Shulgin, A.T.; Mathis, C.A. (Donner Laboratory, Lawrence Berkeley Laboratory, University of California, Berkeley). *Journal of Medicinal Chemistry;* **27**: No. 8, 1071-1077(Aug 1984).

The radioiodine-labeled amines currently available as brain-imaging agents, based on our previous work and that of others, are prepared either by exchange labeling or by direct iodination of a protected intermediate. The intrinsic slowness of these processes limits their potential for use with the positron-emitting 122I, as it has a half-life of only 3.6 min. This isotope has advantages of a low dose to the patient and availability from a generator containing the parent 20-h 122Xe. To develop a radiopharmaceutical in which 122I could be utilized, we prepared a number of secondary and tertiary amines (maintaining the 2,5-dimethoxy substitution pattern which allows direct iodination at the 4-position) with 131I. The organ distributions of these compounds were studied, and the best properties were found in the N,N-dimethyl homologue (2,5-dimethoxy-N,N-dimethyl-4-iodoamphetamine). This compound was successfully synthesized in a matter of seconds, with a chemical yield and radioactive purity both in excess of 90% and an incorporation efficiency of radioiodine of about 40%.

50596 **Role of superconducting magnets in NMR medical imaging.** Green, M.A. (Lawrence Berkeley Laboratory, CA (U.S.A.)); Singer, J.R. (University of California, Berkeley (U.S.A.)). *Journal de Physique (Paris), Colloque;* **45**: 685-690(Jan 1984). (CONF-830971—).

From 8. international conference on magnet technology and exhibition; Grenoble, France (5 Sep 1983).

Modern medicine has become dependent on X-ray and various imaging techniques for the diagnosis of diseases. Within the last five years, an imaging technique which uses NMR (Nuclear Magnetic Resonance) has been developed. NMR imaging will produce

detailed pictures of soft tissues without the use of dangerous ionizing radiation. NMR imaging can be particularly useful for the detection of cancer and certain cardiovascular diseases. NMR imaging may well provide the first large-scale use of superconducting magnet technology by society as a whole. This paper describes the role of superconducting magnets in NMR imaging. The design criteria for superconducting magnets suitable for whole-body imaging of humans are presented. A couple of magnet design approaches are discussed.

50597 **Properties of liposomes containing 212Pb.** Rosenow, M.K.; Zucchini, G.L.; Bridwell, P.M.; Stuart, F.P.; Friedman, A.M. (Argonne National Lab., IL). *International Journal of Nuclear Medicine and Biology;* 10: No. 4, 189-197(1983).

The reverse phase evaporation method was used to prepare lipid bilayer membrane vesicles containing ^{212}Pb and other markers of high specific activity. Electron microscopy and microfiltration were used to measure the sizes of the liposomes. Isotopes were released from the liposomes during exposure to serum and this leakage was prevented by complexing of small molecules with proteins or by precipitating particulate complexes within the liposomes. The in vivo distribution of ^{212}Pb liposomes differed from the distribution of free ^{212}Pb in that the reticuloendothelial system cleared the liposomes. Liposomes with surface dinitrophenol hapten were highly immunogenic and the humoral response to dinitrophenol was nonspecifically suppressed by ^{212}Pb liposomes.

5507 Microbiology

REFER ALSO TO CITATION(S) 55070049606

50598 **(BMFT-FB-T—84-059) Microbial degradation of high nitrogen contents (primarily nitrate) in industrial waste water.** Claus, G.; Kutzner, H.J. (Technische Hochschule Darmstadt (Germany, F.R.). Inst. fuer Mikrobiologie; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Apr 1984. 70p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE84752154.

This study deals with the denitrification of industrial waste water of high nitrate content, including waste water from the recovery process for nuclear material. At first the autotrophic process employing Thiob. denitrificans was investigated: kinetics, stoichiometry, application of a packed bed reactor; effect of nitrate concentration, retention time, loading and height of the reactor on denitrification. The system proved to be useful for waste water with nitrate up to 4.5 g/L; the highest rate of denitrification achieved was 1.5 g/L.h when the retention time was 2.5 h and the nitrate concentration (in-flow) 4.3 g/L (i.e. reactor loading 41 kg NO_3^-/m^3.d). Equally good results were obtained by the heterotrophic process: ethanol allowed a reactor loading of 60 kg NO_3^-/m^3.d; however, in this case bacterial growth tended to clog the column. - Enrichments made with ethanol yielded Ps. aeruginosa as main component of the population; in contrast, those with methanol resulted in a mixture of Hyphomicrobium spec. and Paracoccus denitrificans; this bacterial culture was used to determine the stoichiometry of denitrification in continuous culture; it was also employed to denitrify a diluted solution of nitric acid (0.1 ml HNO_3/L) which could be achieved in continuous culture using a retention time of 25 h.

50599 **(LA-UR—84-2927) Multiparameter light scattering for rapid virus identification.** Salzman, G.C.; Grace, W.K.; McGregor, D.M.; Gregg, C.T. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 8p. (CONF-8405239—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85002039.

From Workshop on applicatons of circularly polarized synchrotron radiation; Albuquerque, NM, USA (18 May 1984).

An instrument for making multiparameter light scattering (MLS) measurements from viral suspensions has been described. Calibration methods and a technique for the correction of artifacts were also presented. This measurement technique may have broad applications in cell biology in general and in virology in particular. It may be possible to use MLS to identify viruses directly from clinical specimens. 8 references, 7 figures.

5509 Pathology

REFER ALSO TO CITATION(S) 55090050614

5510 Physiological Systems

REFER ALSO TO CITATION(S) 55100049606, 50641

50600 **(CONF-821269—2-Draft) Muscle atrophy and restoration during molting.** Mykles, D.L.; Skinner, D.M. (Oak Ridge National Lab., TN (USA)). 1982. Contract AC05-84OR21400. 43p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85000961.

From American Society of Zoologists conference; Louisville, KY, USA (27 Dec 1982).

The ultrastructural basis of atrophy of claw closer muscle of the land crab (Gecarcinus lateralis) and the organization of myofibrils and sarcoplasmic reticulum during the hydrolysis of protein that occurs during proecdysis were examined. Proecdysis was initiated by autotomy of seven or eight walking legs. In some ways, the ultrastructure of the accompanying claw muscle atrophy resembles that of other atrophies induced by denervation, disuse, and disease in that lysosomes do not appear to be involved in myofilament degradation. The changes that occur in contractile proteins during claw muscle atrophy and the involvement of Ca^{2+}-dependent proteinase (CDP) in myofilament degradation were investigated. In contrast to other systems, there is a preferential degradation of thin filaments relative to thick filaments, resulting in an increase in thick-filament packing density. Crab CDP hydrolyzes several myofibrillar proteins including actin and myosin. Its activity is more than two-fold greater in proecdysial muscle, suggesting that the CDP plays a significant role in claw muscle atrophy. 68 references, 12 figures. (ACR)

50601 **(CONF-8405243—1) Role of calcium-dependent proteinase in molt-induced claw muscle atrophy.** Mykles, D.L.; Skinner, D.M. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001275.

From 5. international symposium on intracellular protein catabolism; Airlie, VA, USA (29 May 1984).

The claw closer muscle of the Bermuda land crab Gecarcinus lateralis undergoes a sequential atrophy and restoration during each intermolt cycle. Muscle protein decreases 40% during proecdysis and is restored following ecdysis. Amino acid incorporation into protein of postecdysial muscle is five times greater than that in anecdysial muscle. Since the rates of protein synthesis in anecdysial and proecdysial muscle are the same it appears that proecdysial muscle atrophy is caused primarily by an increase in protein degradation. A calcium-dependent proteinase (CDP) active at neutral pH has been implicated in the nonlysosomal hydrolysis of myofibrillar proteins. We have examined the role of a CDP in atrophy of the claw closer muscle. The many similarities between crustacean and vertebrate CDPs have established this crustacean system as a simple and convenient model for the role of Ca^{2+}-dependent proteolysis in myofibrillar protein turnover and its manifestation in the structure of the sarcomere. 16 references, 8 figures. (ACR)

5530 Agriculture And Food Technology

REFER ALSO TO CITATION(S) 55300049679, 50280

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

REFER ALSO TO CITATION(S) 56012050275, 50276, 50591, 50630

50602 **(BNL—35250) Towards a molecular understanding of sunlight-induced skin cancer in mouse and man.** Sutherland, B.M. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 8p. (CONF-840783—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85000236.

From 9. international congress on photobiology; Philadelphia, PA, USA (3 Jul 1984).

In order to develop cellular models for studying induction of abnormal growth in human cells by ultraviolet radiation, a procedure was developed for the uv transformation of normal human cells. Important features of this procedure include: (1) the cells are low passage normal human cells; (2) there are multiple uv exposures; and (3) the cells are allowed to grow to develop and express any unusual traits. 10 references. (ACR)

50603 **(CEA-N—1434) Absorption of ^{45}Ca during the immersion of the aerial organs of Salicornia stricta.** Langlois, J.; Vilquin, A. (Caen Univ., 14 (France). Lab. de Physiologie Vegetale; CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Section de Radioecologie). Apr 1971. 12p. (In French). NTIS (US Sales Only), PC A02/MF A01. File Number DE85900017.

Immersion of the aerial organs of Salicornia stricta in a nutrient solution with added radioactive ^{45}Ca resulted in the accumulation of ^{45}Ca in the aerial organs. There was no accumulation when the roots were immersed in the nutrient solution. Absorption of minerals by the stems and leaves of Salicornia during periodic submersions in the brackish water surrounding the plants, is therefore possible. 17 references, 1 figure, 1 table.

50604 **(CONF-8309281—1) Radiation research report.** Fry, R.J.M. (Oak Ridge National Lab., TN (USA)). 1983. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001186.

From Workshop on neutron carcinogenesis; Oak Ridge, TN, USA (19 Sep 1983).

A brief report is provided on a workshop on neutron carcinogenesis. Topics discussed include dosimetry, biophysics, in vitro transformation and carcinogenesis in experimental animals. (ACR)

50605 **(CONF-8403150—1) Radiation, chemicals, and occupational health research.** Turner, J.E. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 23p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000973.

From DOE-OHER workshop on monitoring and dosimetry in an occupational health research program for synfuel technologies; Knoxville, TN, USA (20 Mar 1984).

Radiation protection and its interplay with physical research programs are described. Differences and similarities between problems in health protection for chemicals and for radiation are discussed. The importance of dosimetry in radiation work and its relevance to chemicals are cited. A collaborative program between physical and biological scientists on the toxicity of metals is briefly described. It serves as an example of new research directed toward the development of fundamental concepts and principles as a basis for understanding and controlling occupational and population exposures to chemicals. 12 references, 4 figures.

50606 **(CONF-8405207—2) Report on NCI symposium: comparison of mechanisms of carcinogenesis by radiation and chemical agents. II. Cellular and animal models.** Fry, R.J.M. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 22p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001867.

From Symposium on assessment of risk from low level exposure to radiation and chemicals; Upton, NY, USA (20 May 1984).

The point at which the common final pathway for induction of cancer by chemical carcinogens and ionizing radiation has not been identified. Although common molecular targets are suggested by recent findings about the role of oncogenes, the mechanism by which the deposition of radiation energy and the formation of adducts or other DNA lesions induced by chemicals affects the changes in the relevant targets may be quite different. The damage to DNA that plays no part in the transformation events, but that influences the stability of the genome, and therefore, the probability of subsequent changes that influence tumorigenesis may be more readily induced by some agents than others. Similarly, the degree of cytotoxic effects that disrupt tissue integrity and increase the probability of expression of initiated cells may be dependent on the type of carcinogen. Also, evidence was presented that repair of the initial lesions could be demonstrated after exposure to low-LET radiation but not after exposure to chemical carcinogens.

50607 **(CONF-8406167—5) Approaches to radiation guidelines for space travel.** Fry, R.J.M. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 25p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001248.

From 25. plenary session of COSPAR; Graz, Austria (25 Jun 1984).

There are obvious risks in space travel that have loomed larger than any risk from radiation. Nevertheless, NASA has maintained a radiation program that has involved maintenance of records of radiation exposure, and planning so that the astronauts' exposures are kept as low as possible, and not just within the current guidelines. These guidelines are being reexamined currently by NCRP Committee 75 because new information is available, for example, risk estimates for radiation-induced cancer and about the effects of HZE particles. Furthermore, no estimates of risk or recommendations were made for women in 1970 and must now be considered. The current career limit is 400 rem. The appropriateness of this limit and its basis are being examined as well as the limits for specific organs. There is now considerably more information about age-dependency for radiation and this will be taken into account. Work has been carried out on the so-called microlesions caused by HZE particles and on the relative carcinogenic effect of heavy ions, including iron. A remaining question is whether the fluence of HZE particles could reach levels of concern in missions under consideration. Finally, it is the intention of the committee to indicate clearly the areas requiring further research. 21 references, 1 figure, 7 tables.

50608 **(CONF-8410147—2) Current (1984) status of the study of ^{226}Ra and ^{228}Ra in humans at the Center for Human Radiobiology.** Rundo, J.; Keane, A.T.; Lucas, H.F.; Schlenker, R.A.; Stebbings, J.H.; Stehney, A.F. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 17p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002150.

From Radiobiology of radium and thorotrast conference; Neuherberg, F.R. Germany (29 Oct 1984).

The Center for Human Radiobiology has identified 5784 persons by name and type of exposure to ^{226}Ra and ^{228}Ra. Included are 4863 dial painters (mostly women) and non-laboratory employees of the radium dial industry, 410 laboratory workers, 399 persons who received radium for supposed therapeutic effects, and 112 in other categories. Body contents of radium have been measured in 1916 of the dial workers and about one-half of the subjects in the other groups. Bone sarcomas, carcinomas of the paranasal sinuses and mastoids, and deterioration of skeletal tissue are still the only effects unequivocally attributable to internal radium. Excess leukemias have not been observed and other malignancies, if in excess, appear more likely to be related to external gamma radiation or radon than to internal radium. Positive correlations with radium burdens have been found for the incidence of benign exostoses among subjects exposed to radium before age 18 and for shortened latency of ocular cataracts. 26 references, 3 figures, 5 tables.

50609 **(DOE/ER/60169—T1) Delayed immunologic effects of low dose radiation in Japanese A-bomb survivors. Technical progress report.** Makinodan, Takashi; Bloom, E.T. (Radiation Effects Research Foundation, Hiroshima (Japan); Veterans Administration Medical Center, Los Angeles, CA (USA). Geriatric Research, Education and Clinical Center; California Univ., Los Angeles (USA). Dept. of Medicine). [1984]. Contract AT03-83ER60169. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001943.

Progress is reported on a project to analyze the level of circulating immune complexes in atomic bomb survivors. (ACR)

50610 **(ENEA-RT/BIO—82-21) Role of histological techniques for preparation of bone in studies of Pu.** Alati, T. (ENEA, Casaccia (Italy). Centro Ricerche Energia). 1982. 28p. (In Italian). NTIS (US Sales Only), PC A03/MF A01. File Number DE84703134.

Techniques and methodologies for histological preparation of bone samples from plutonium-contaminated laboratory mice are described in the present report. These techniques have been set up within a research program on Pu-239 toxicity at low and very low activities. Pu-239 is a well-known alpha emitter with high relative biological effectiveness; when incorporated in mammalian organism it is also taken up by bone surfaces where osteosarcomas may be induced. This effect is very probably associated to the particular spatial relationships between the incorporated radionuclide and the target cells at risk. The research program actually in progress includes both the studies of late pathological effects, mainly in terms of bone tumor incidence and rate, and the quantitative description of the spatial relationships mentioned above. Within this framework, the techniques to be described refer to the preparation of histological samples of demineralized bones for traditional histopathological analyses and of mineralized bones for studies of Pu-239 microdistributions by means of fission track analyses.

50611 **(ENEA-RT/PROT—83-9) Plutonium contamination in Italian population.** Cave-Bondi, G.; Merli, S.; Rogo, M.; Sgarbazzini, M.; Clemente, G.F.; Mancini, L.; Santori, G.; Tardella, Q. (ENEA, Casaccia (Italy). Centro Ricerche Energia). 1983. 70p. (In Italian). NTIS (US Sales Only), PC A04/MF A01. File Number DE84703135.

The literature data concerning the biological and the chemical physical characteristics of plutonium are summarized in the first part of the paper. The experimental results of the plutonium concentration in complete diets, single food items and some human autopsy tissues, regarding the Italian situation, are then presented and discussed. Our experimental data are in good agreement with similar data reported in several studies carried out in some countries of the north hemisphere.

50612 (INIS-mf—9053, pp 5-10) **Radiobiological basis of radiation hygiene.** Barendsen, G.W. (Amsterdam Univ. (Netherlands). Lab. voor Radiobiologie). 1982. (In Dutch). NTIS (US Sales Only), PC A05/MF A01. File Number TI85780001. (CONF-820199—).

From Occupational health aspects of ionising radiation meeting; Amsterdam, Netherlands (6 Jan 1982).

After a short introduction on radiation sources and population doses, the early and late effects of ionizing radiations on man are surveyed with reference to dose dependence. Extrapolation from known data on carcinogenesis by 50 rad or higher, to lower doses is possible, and recommended by ICRP.

50613 **(INIS-mf—9068) Meat symposium. The vital role of science and technology in the meat industry.** (Animal and Dairy Science Research Inst., Verwoerdburg, Pretoria (South Africa)). 1982. 250p. (CONF-8211182—). NTIS (US Sales Only), PC A11/MF A01. File Number DE85780060.

From Meat symposium - the vital role of science and technology in the meat industry; Pretoria, South Africa (22 Nov 1982).

Separate abstracts have been prepared for items within the scope of the Energy Data Base.

50614 **(Juel—1897) Retention of incorporated radionuclides after variable application of gamma-rays.** Bornschein, R. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Medizin; Technische Hochschule Aachen (Germany, F.R.)). Feb 1984. 125p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE84752160.

The effect of gamma-rays on the syngenic system adenocarcinoma EO 771 in male C 57 BL/6J mice is examined. Both pulse irradiations and fractionated irradiations are applied. In vivo conditions are made possible by external measurement techniques. Measurements of tumor volume are correlated with measurements of activity after injection of 125-I labelled 5-iodo 2'-deoxyuridine. Incoporation of activity and activity loss are measured and interpreted in terms of cell production and cell loss. In addition, invasive examinations are performed after injection of the vital dye light green SF and then excision of the viable and necrotic tissue from the tumor. A model is developed to predict the tumor growth. The parameters are calculated from the results of irradiation experiments.

50615 **(NUREG—1029) Computer code for general analysis of radon risks (GARR).** Ginevan, M. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Radiation Programs and Earth Sciences). Sep 1984. 92p. NTIS, PC A05/MF A01 - GPO* $4.50. File Number TI85900038.

This document presents a computer model for general analysis of radon risks that allow the user to specify a large number of possible models with a small number of simple commands. The model is written in a version of BASIC which conforms closely to the American National Standards Institute (ANSI) definition for minimal BASIC and thus is readily modified for use on a wide variety of computers and, in particular, microcomputers. Model capabilities include generation of single-year life tables from 5-year abridged data, calculation of multiple-decrement life tables for lung cancer for the general population, smokers, and nonsmokers, and a cohort lung cancer risk calculation that allows specification of level and duration of radon exposure, the form of the risk model, and the specific population assumed at risk. 36 references, 8 figures, 7 tables.

50616 **Effects of cellular non-protein sulfhydryl depletion in radiation induced oncogenic transformation and genotoxicity in mouse C_3H 10T1/2 cells.** Hei, T.K.; Geard, C.R.; Hall, E.J. (Columbia Univ., New York, NY). *International Journal of Radiation Oncology, Biology and Physics;* **10**: No. 8, 1255-1259(Aug 1984). Contract AC02-83ER60142.

A study was made of the effects of cellular non-protein sulfhydryl (NPSH) depletion on cytotoxicity, cell cycle kinetics, oncogenic transformation and sister chromatid exchange (SCE) in C_3H 10T1/2 cells. Using DL-Buthionine S-R-Sulfoximine (BSO) to deplete thiols, it was found spectrophotometrically that less than 5% of control NPSH level remained in the cells after 24-hour treatment under aerated conditions. Such NPSH depleted cells, when subject to a 3 Gy γ-ray treatment, were found to have no radiosensitizing response either in terms of cell survival or oncogenic transformation. In addition, decreased levels of NPSH had no effect on spontaneous or radiation-induced SCE nor were cell cycle kinetics additionally altered. Therefore, the inability of NPSH depletion to alter γ-ray induced cellular transformation was unrelated to any possible effect of BSO on the cell cycle. These results suggest that such depletion may result in little or no additional oncogenic or genotoxic effects on aerated normal tissues.

50617 **Paraquat and radiation effects on mouse C_3H 10T1/2 cells.** Geard, C.R.; Shea, C.M.; Georgsson, M.A. (Columbia Univ., New York, NY). *International Journal of Radiation Oncology, Biology and Physics;* **10**: No. 8, 1407-1410(Aug 1984). Contract AC02-78EV04733.

The dipyridilium compound, paraquat, has been used in conjunction with mouse C_3H 10T1/2 cells to determine if this superoxide (O_2^-) generating agent acts to oncogenically transform, chromosomally alter or influence cytokinetics or cellular survival. Paraquat alone is a cytotoxic agent and is additionally a weak radiosensitizer. A 0.1 mM 24 hour treatment results in about 30% cell survival and enhances the cell killing effects of ^{137}Cs gamma rays by a factor of about 1.2. The drug appears to function lethally by initiat-

ing an interphase cell death, and additionally slows the movement of cycling cells through the cell cycle. It is a poor inducer of SCE's and combined effects with radiation are strictly additive. Paraquat oncogenically transforms cells but not in a dose-dependent manner, yet combined treatments with 3 Gy result in transformation frequencies greater than expected for additive effects. Depending on the endpoint examined, which may be related to the degree of nuclear involvement, paraquat either acts additively (SCE's) or with greater than an additive effect (cell survival and oncogenic transformation).

50618 **Hypoxic cell sensitizers and heavy charged particle beams may play complementary roles in killing hypoxic tumor cells.** Curtis, S.B.; Tenforde, T.S.; Afzal, S.M.J. (Lawrence Berkeley Lab., CA). *International Journal of Radiation Oncology, Biology and Physics;* **10**: No. 8, 1203-1205(Aug 1984). Contract AC03-76SF00098.

The analysis of growth delay data of a rat rhabdomyosarcoma tumor system with and without misonidazole and irradiated with spread-peak heavy-ion radiation yields two conclusions that bear on the relative efficacy of the two modes of treatment and imply a complementary role of the two modes which enhances the effects of either given separately. For both carbon and neon ion peak radiation given in four fractions, RBE values for tumor growth delay are significantly greater than the enhancement ratio for an x ray plus misonidazole fractionation scheme. When misonidazole is given in conjunction with the heavy ion beam irradiations, an increased growth delay is seen, greater than when either heavy ions or misonidazole plus x rays are given separately. The interpretation is that heavy ion beams reach and kill hypoxic cells not penetrated by the misonidazole, and some hypoxic cells not killed by the high LET component receive low LET damage which is made lethal by the drug. Thus, the net hypoxic cell killing is enhanced by the high LET beams and in a complementary way by the combination of the drug and the low LET portion of the radiation.

50619 **Limited life-table factors for estimating radiation-induced cancers over finite time periods.** Maillie, H.D. (Univ. of Rochester School of Medicine and Denistry, NY). *Health Physics;* **47**: No. 1, 47-57(Jul 1984). Contract AC02-76EV03490.

A method is presented that allows the estimation of radiation-induced cancer incidence or mortality at varying times post-exposure in irradiated populations of males or females of ages ranging from 10 to 70 yr. Limited life-table factors are given in graphic form for 2 sets of conditons: when the latent period is 2 yr and the plateau 30 yr and when the latent period is 10 yr and the plateau extends to the end of life. Normal incidences for selected forms of cancer are also presented. Examples are given that show how to calculate the radiation excess cancers and to compare this excess with the normal. The implications of these numbers are also discussed.

50620 **Toxicology of ^{85}Kr: chronic exposure studies.** Ballou, J.E.; Willard, D.H.; Dagle, G.E.; Murphy, D.W.; Eichner, F.N.; Tolley, H.D. (Pacific Northwest Lab., Richland, WA). *Health Physics;* **47**: No. 1, 59-71(Jul 1984). Contract AC06-76RL01830.

Male and female Wistar rats were exposed chronically to graded doses of ^{85}Kr to determine long-term biological effects of simulated environmental exposure. Rats were exposed in 4 groups, including room air-exposed controls and 3 groups exposed to ^{85}Kr concentrations equivalent to 10^2, 10^3 and 10^4 times the maximum permissible concentration (MPC) for the general population (3 X 10^{-7} μCi/ml). Exposures continued 24 hr/day, 7 days/week for 808 days, until only ~ 10% of the original 400 rats were alive. No effect of ^{85}Kr exposure was observed on weight gain or tumor incidence, including leukemias. The results support the adequacy of established ^{85}Kr exposure limits for the general population in light of the absence of evidence of build-up in tissues after chronic exposure.

50621 **Plutonium-induced wounds in beagles.** Dagle, G.E.; Bristline, R.W.; Lebel, J.L.; Watters, R.L. (Pacific Northwest Lab., Richland, WA). *Health Physics;* **47**: No. 1, 73-84(Jul 1984). Contract AC06-76RL01830.

Beagle dogs were given subcutaneous implants of plutonium in their forepaws to mimic hand wounds received by workers accidentally contaminated with plutonium. Ten dogs received 9.46 +/- 0.43 μCi of plutonium oxide, and eight dogs received 1.25 +/- 0.60 μCi of plutonium nitrate. Surviving dogs were sacrificed at 8 and 5 yr, respectively, after exposure, and radioanalyses were performed on the injection site, regional lymph nodes, liver, spleen and bone. Histopathologic and autoradiographic examinations were performed on injection sites, regional lymph nodes, livers, spleens, kidneys and grossly observed lesions. The injected paws sequestered 21 and 16% respectively, of the injected activity from plutonium oxide and plutonium nitrate in hypocellular scar tissue. The highest concentrations of translocated radionuclides were found in the regional lymph nodes. The liver had the next highest concentration for both radionuclides; activity was present as alpha stars. The spleen had the next highest concentration for plutonium-oxide-injected dogs, although concentrations in the spleen were lower than the skeleton in the plutonium-nitrate-injected dogs.

50622 **Studies of plutonium workers.** Voelz, G.L. (Los Alamos National Laboratory, P.O. Box 1663, Los Alamos, NM 87545). *Transactions of the American Nuclear Society;* **46**: 318-319(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

50623 **The U.S. Transuranium Registry: The final contribution or ultimate gift.** Swint, M.J.; Kathren, R.L. (Hanford Environmental Health Foundation, P.O. Box 100, Richland, WA 99352). *Transactions of the American Nuclear Society;* **46**: 317-318(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

50624 **Report of an accidental acute human exposure to ^{241}Am.** Breitenstein, B.D. Jr. (Hanford Environmental Health Foundation, P.O. Box 100, Richland, WA 99352). *Transactions of the American Nuclear Society;* **46**: 319-320(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

50625 **Neptunium revisited.** Thompson, R.C. (Battelle-Pacific Northwest Laboratory, P.O. Box 999, Richland, WA 99352). *Transactions of the American Nuclear Society;* **46**: 319(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

50626 **Delayed sequelae of pituitary irradiation.** Woodruff, K.H.; Lyman, J.T.; Lawrence, J.H.; Tobias, C.A.; Born, J.L.; Fabrikant, J.I. (Univ. of California, Berkeley). *Human Pathology;* **15**: No. 1, 48-54(Jan 1984).

Since 1958, 781 patients at Lawrence Berkeley Laboratory have received helium-particle stereotactic radiosurgery to the adenohypophysis. Autopsy findings in 15 of these patients are reported. Ten patients received pituitary radiation (average dose, 116 Gy in six fractions) for progressive neovascularization retinopathy due to diabetes mellitus. Evidence of a time-dependent course of progressive fibrosis in their pituitary glands was found. Five patients were treated for eosinophilic adenomas. Although they had lower average doses of radiation (56 Gy in six fractions), their pituitary glands showed cystic cavitation of the adenomas. The adenomas thus appeared more radiosensitive than the normal pars anterior, which, in turn, was more radiosensitive than the adjacent neurohypophysis. No significant radiation changes were found in the surrounding brain or cranial nerves. The endocrine organs under pituitary control showed varying degrees of atrophy, and clinical tests revealed progressive hypofunction. It was concluded that charged-particle therapy produced a sharply delineated focal ral tests revealed progressive hypofunction. It was concluded that charged-particle therapy produced a sharply delineated focal radiation lesion confined to the pituitary gland but did not cause injury to the critical structures of the surrounding central nervous system.

50627 **Response of sensitive human Ataxia and resistant T-1 cell lines to accelerated heavy ions.** Tobias, C.A.; Blakely, E.A.; Chang, P.Y.; Lommel, L.; Roots, R. (Lawrence Berkeley Lab., CA (USA)). *British Journal of Cancer;* **49**: No. 6, 175-185(1984). (CONF-830782—).

From 11. L. H. Gray conference on cellular repair of radiation damage - mechanisms and modifying agents; Glasgow, UK (18 Jul 1983).

The radiosensitivity of Ataxia and T-1 cells was compared, using aerobic and hypoxic 225 kVp x-ray survival curves as controls to nearly monoenergetic accelerated neon and argon ions, LET of the particles varied from 30 keV μm^{-1} to over 1,000 keV μm^{-1}. All Ataxia survival curves were exponential functions of the dose, radiosensitivity reaching peak values at 100-200 keV μm^{-1}. Human T-1 cells have effective sublethal damage repair, evidenced by split dose experiments, being much more resistant to low than high LET, when their radiosensitivity approached that of Ataxia cells. According to the repair-misrepair model, molecular repair processes culminate either in eurepair or misrepair. Mathematical expressions were obtained describing the cross sections and inactivation coefficients for both human cell lines as a function of the LET and type of particle used, assuming the lesions induced in T-1 and Ataxia cells to be qualitatively similar and that each line attempts to repair these lesions. The result in most irradiated Ataxia cells, however, is either lethal misrepair or incomplete repair leading to cell death. The model suggests that at high LET, T-1 cells can still efficiently repair individual lesions, but as lesions become closely spaced along the tracks, probability of misrepair increases.

5602 Thermal Effects

REFER ALSO TO CITATION(S) 56020050551

5603 Chemicals Metabolism And Toxicity

REFER ALSO TO CITATION(S) 56030049427, 50521, 50551, 50605, 50606

50628 **(AD-A—142428/2) Chemical and molecular biological aspects of alkylhydrazine-induced carcinogenesis in human cells in vitro. Revised. Final report 1 July 1980-30 September 1983.** Witiak, D.T. (Ohio State Univ. Research Foundation, Columbus (USA)). Apr 1984. 78p. NTIS, PC A05/MF A01.

The syntheses for 1,1-(methyl-14C)-dimethylhydrazine, 1,2-(methyl-14C)-dimethylhydrazine, and the important metabolite of 1,2-dimethylhydrazine, namely, 14C-methylazoxymethanol as an acetate derivative are described. Materials for high specific activity were employed to (1) Investigate early events in carcinogenesis; (2) Study DNA modification and damage; and (3) Probe effects of anticarcinogen benzamide, on molecular perturbation of DNA by methylazoxymethanol acetate.

50629 **(BNL—51783) Health effects of risk-assessment categories.** Kramer, C.F.; Rybicka, K.; Knutson, A.; Morris, S.C. (Brookhaven National Lab., Upton, NY (USA)). Oct 1983. Contract AC02-76CH00016. 255p. NTIS, PC A12/MF A01; 1; GPO Dep. File Number DE85002131.

Environmental and occupational health effects associated with exposures to various chemicals are a subject of increasing concern. One recently developed methodology for assessing the health impacts of various chemical compounds involves the classification of similar chemicals into risk-assessment categories (RACs). This report reviews documented human health effects for a broad range of pollutants, classified by RACs. It complements other studies that have estimated human health effects by RAC based on analysis and extrapolation of data from animal research.

50630 **(CONF-8309285—1) Use of cytogenetic endpoints in human lymphocytes as indicators of exposure to genotoxicants.** Preston, R.J. (Oak Ridge National Lab., TN (USA)). 1983. Contract AC05-84OR21400. 22p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001262.

From Symposium on new approaches in toxicity testing and their application to human risk assessment; St. Louis, MO, USA (14 Sep 1983).

The utility of the lymphocyte assay for chemical exposures is discussed, with reference to the underlying mechanisms of induction of chromosome alterations. Possible ways of increasing the sensitivity of the assay in order to make it more useful for population monitoring are also discussed. 28 references. (ACR)

50631 **(CONF-8404193—Abstr.) Silica, silicosis and cancer. An international symposium.** (North Carolina Univ., Chapel Hill (USA). Dept. of Environmental Sciences and Engineering; Society for Occupational and Environmental Health, New York (USA)). 1984. Contract FG05-84ER60212. 38p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84017494.

From International symposium on silica, silicosis and cancer; Chapel Hill, NC, USA (3 Apr 1984).

The research areas discussed in the symposium include: (1) history of silicosis and SiO_2 dust measurement; (2) silicosis: present and future; (3) recent epidemiologic research; (4) recent pathphysiology of SiO_2; (5) biologic and tumorigenic response to silica; (6) silica and cancer bioassays; (7) new standards; (8) future trends and pitfalls in SiO_2 research; (9) silicosis, dusty trades, and cancer; and (10) confounding and summarization.

50632 **(CONF-8405207—3) Control of mutagenesis and cell differentiation in cultured human and rodent cells by chemicals that initiate or promote tumor formation.** Huberman, E.; Jones, C.A. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85000083.

From Symposium on assessment of risk from low level exposure to radiation and chemicals; Upton, NY, USA (20 May 1984).

The ability of tumor initiators and promoters to induce mutagenesis and cell differentiation in a variety of mammalian cell systems was studied. 113 references, 4 figures, 5 tables. (ACR)

50633 **(CONF-8408105—1) Chelation and effectiveness of salicylate related compounds on pyresis, sedimentation rate and hematocrit.** Schubert, J.; Rosenthal, M.W.; Fried, J.F. (Maryland Univ., Catonsville (USA). Dept. of Chemistry; Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84015844.

From 9. international congress of pharmacology satellite symposium; Pilsen, Czechoslovakia (6 Aug 1984).

The mechanism of action and identification of sites of salicylates and related compounds in antipyresis were studied. Structure-activity investigations of antipyresis were made using Sprague-Dawley rats. Results showed copper was chelated by the salicylate, passes through the cell membrane, and repairs the lesion. 13 references, 2 figures. (ACR)

50634 **(DOE/EV/10252—T2) Petroleum effects on neural systems in marine organisms. Progress report, 1 August 1979-14 April 1980.** (California Univ., Santa Barbara (USA). Marine Science Inst.; California Univ., Los Angeles (USA)). 1980. Contract AT03-79EV10252. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85000720.

Progress is reported in the following areas: (1) petroleum effects on chemosensory systems in the kelp crab, Pugettia producta, and the California spiny lobster, Panulirus interruptus; (2) chemosensory bradycardia in the spiny lobster; (3) petroleum effects on epithelial potentials in the coelenterate Tubularia; (4) petroleum effects on bioluminescence in the marine dinoflagellate, Pyrocystis fusiformis; and (5) analysis of petroleum for neurological testing on crustacea. (ACR)

50635 **(GSF-A—2/84) Compilation of data sources for existing chemicals.** Voigt, K.; Rohleder, H. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.)). Apr 1984. 111p. Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg, Germany, F.R.. File Number TI85750065.

The compilation presented here originates from our current work on modelling the behaviour of chemicals in the ecosphere for a comparative estimation of their environmental hazard potentials.

This project is granted by the Umweltbundesamt (Federal Environmental Agency of the Federal Republic of Germany). The compilation is primarily intended as a tool for the so-called priority setting process, i.e. the selection of those substances among existing chemicals that most urgently need information and data development for environmental and/or human health hazard assessment. The hazard potential of different substances may vary considerably, and it seems reasonable to reduce the number of chemicals stepwise. As a consequence, some basic data are needed for many chemicals in the early stages of priority setting while more and more data become necessary in the later stages leading eventually to hazard assessment that will require a comprehensive set of information and data. With that concept in mind, preference has been given to handbooks and tables because they usually cover broad ranges and varieties of substances. Monographs, reports and other printed documents are included whenever they give valuable data compilations for important properties. Furthermore, some computerized data bases are incorporated if they offer experimental data.

50636 **(ORNL/TM—9096) Inhalation pathway risk assessment of hazardous waste incineration facilities.** Travis, C.C.; Etnier, E.L.; Holton, G.A.; O'Donnell, F.R.; Hetrick, D.M.; Dixon, E.; Harrington, E.S. (Oak Ridge National Lab., TN (USA)). Oct 1984. Contract AC05-84OR21400. 145p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE85001694.

The purpose of this assessment was to determine the relative importance of plant design and waste physicochemical variables on human inhalation exposure and health risk resulting from hazardous waste incineration. A hypothetical waste incineration site in the northern Midwest was chosen as the primary site for analysis. This site has a population of 0.45 x 10^6 persons, with the closest individuals residing 1500 m from the incineration site. Two facility designs (liquid injection and rotary kiln) of three sizes (1, 10, and 150 x 10^6 Btu/h), each burning three generic wastes, were selected. Three levels of destruction and removal efficiency (DRE) were considered (99.0, 99.9 and 99.99% DRE). The three waste groups selected for study, in order of increasing incinerability were: (1) pesticide-related chemicals (chloroform, ethylene dichloride, hexachlorobutadiene, and 1,1,2,2-tetrachloroethane); (2) API separator sludge chemicals (arsenic, chromium, lead, and phenol) and (3) phenol/acetone distillation chemicals (toluene, pyridine, phthalic anhydride, and methyl styrene). Annual-average ground level air concentrations of representative chemical pollutants were estimated using IEM, an automated inhalation exposure methodology. Air concentrations were estimated for both stack and fugitive emissions using region-specific meteorological and climatological data. Estimates of individual and total population exposure resulting from incineration of hazardous materials were calculated and estimates of risk obtained. 31 references, 36 tables. (ACR)

50637 **(PNL-SA—12412) Mutagenicity and carcinogenicity of polycyclic aromatic enriched fractions from coal liquefaction materials.** Pelroy, R.A.; Frazier, M.E.; Stewart, D.L.; Later, D.L.; Mahlum, D.D. (Pacific Northwest Lab., Richland, WA (USA)). May 1984. Contract AC06-76RL01830. 9p. (CONF-840781—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85000375.

From International conference on environmental contamination; London, UK (10 Jul 1984).

The mutagenicity and carcinogenicity of synthetic fuels from several sources were compared. In vitro tests consisted of the standard histidine reversion test with Salmonella typhimurium TA-98, the Chinese hamster ovary (CHO) forward mutation assay and the Syrian hamster embryo (SHE) transformation assay. In vivo carcinogenesis tests consisted of the mouse skin painting initiation/promotion (I/P) and chronic mouse skin painting assays. Materials tested included: Wilmington crude petroleum, shale oil, solvent refined coal (SRC)-I and -II liquids; and chemical class fractions prepared from SRC-II distillate fractions. Wilmington crude petroleum was mutagenically inactive in the Ames assay but induced low levels of transformation in the SHE assay and the formation of tumors in both the I/P and chronic skin painting assays. Most of the mutagenic, cell-transforming and carcinogenic activities of coal liquids were localized in material that distilled above 700°F. When chemical class fractions from SRC-II distillates were assayed for biological activity, most of the carcinogenic activity was localized in the neutral polycyclic aromatic hydrocarbons (PAH) and nitrogen polycyclic aromatic compound (NPAC) fractions. The highest microbial mutagenic activity was found in the NPAC fraction, although lower levels of significant activity were also found in the PAH and hydroxy polycyclic aromatic hydrocarbon (HPAH). The mammalian in vitro assays were especially sensitive to PAH but also showed a response to other chemical classes. The mammalian in vitro assays were much more sensitive to the PAH fractions than was S. typhimurium TA-98, while the microbial mutagenicity test was more responsive to NPAC and HPAH constituents. 27 references, 4 figures.

50638 **Distribution, retention, and fate of 2-aminoanthracene in rats after inhalation.** Mitchell, C.E.; Henderson, R.F.; McClellan, R.O. (Inhalation Toxicology Research Institute, Lovelace Biomedical and Environmental Research Institute, Albuquerque, New Mexico). *Toxicology and Applied Pharmacology;* **75**: No. 1, 52-59(Aug 1984).

The distribution, retention, and fate of 2[3H]aminoanthracene (2-AA) were determined in male Fischer-344 rats after inhalation exposure (70 micrograms/liter; activity mass median diameter ? 2.1 micron) for 30 min. Radioactivity was found in the turbinates, trachea, lungs, liver, kidneys, and gastrointestinal tract 20 min after exposure. Lower quantities of radioactivity were found in fat, brain, testes, and muscle. Inhaled 2-AA was excreted predominantly in feces (80%). The remaining 2-AA was excreted in urine. Organic soluble radioactivity was released from urinary conjugates after treatment of urine with acid and with beta-glucuronidase. This result suggests that glucuronides of both ring- and N-hydroxy-2-AA were excreted. The remaining radioactivity was water soluble and accounted for approximately one-half of the total urinary radioactivity. The organic soluble radioactivity found after hydrolysis indicated that inhaled 2-AA is extensively metabolized by rats after inhalation and excreted as conjugated metabolites. Eighty-three percent of orally administered material was absorbed into the body from the GI tract; thus, material cleared by mucociliary action after inhalation would contribute to total body burden. 2-AA, a nitrogen substituted polycyclic aromatic hydrocarbon (PAH), was very similar to other PAHs in its rapid distribution throughout the body and in its route of excretion after inhalation.

50639 **Uptake rate of nitrogen dioxide by potato plants.** Sinn, J.P.; Pell, E.J.; Kabel, R.L. (Pennsylvania State Univ., University Park). *Journal of the Air Pollution Control Association;* **34**: No. 6, 668-669(Jun 1984). Contract AC02-77EV04331.

Greenhouse-grown potato plants were exposed to nitrogen dioxide in an exposure chamber to determine the rate of NO_2 uptake at concentrations from 228 to 817 $\mu g/m^3$ (0.12-0.43 ppm). Results show that a consistent increase in uptake rate accompanied an increase in NO_2 exposure concentrations. Exposure in the range of concentration had no significant effect on leaf diffusive resistance.

50640 **Chemical and biological properties of diesel exhaust particles collected during selected segments of a simulated driving cycle.** Bechtold, W.E.; Dutcher, J.S.; Mokler, B.V.; Lopez, J.A.; Wolf, I.; Li, A.P.; Henderson, T.R.; McClellan, R.O. (Inhalation Toxicology Research Institute, Lovelace Biomedical and Environmental Research Institute, Albuquerque, New Mexico). *Fundamental and Applied Toxicology;* **4**: No. 3, 370-377(Jun 1984).

Particle emissions, percentage of organic extractable materials, and mutagenicities of extracts from a diesel engine operating on a test stand have been determined for the full Federal Test Procedure driving cycle and several individual segments thereof. Particle samples were collected using a computer controlled high volume sampler. Extracts of the exhaust particles were screened for the potent mutagens nitropyrene/nitrofluoranthenes by mass spectrometry/mass spectrometry (MS/MS). Results indicate that a long acceleration from 0-55 mph produced approximately seven times more particles per second than the full cycle. Also, the 0- to 55-mph acceleration and a subsequent 55-mph cruise produced significantly higher amounts of mutagens than other segments or the full FTP cycle. A direct correlation of both NOx levels and temperature

with mutagenicity was noted (r ? 0.89 and r ? 0.89). The specific activities of the extracts showed decreases or remained unchanged when assayed in TA-98 NR or TA-98 1,8 DNP6, nitroreductase deficient strains of TA-98. Three extracts were found to have high levels of nitropyrenes/nitrofluoranthenes, and two of the three had high specific activities in TA-98.

50641 **Respiratory tract clearance of ^{14}C-labeled diesel exhaust compounds associated with diesel particles or as a particle-free extract.** Sun, J.D.; McClellan, R.O. (Inhalation Toxicology Research Institute, Lovelace Biomedical and Environmental Research Institute, Albuquerque, New Mexico). *Fundamental and Applied Toxicology;* **4**: No. 3, 388-393(Jun 1984).

Radiolabeled diesel exhaust particles or dichloromethane extracts of these particles were intratracheally instilled (10 mg) into Fischer-344 rats and the clearance of 14C radioactivity was measured. Approximately 88% of the 14C radioactivity associated with the particles was soluble in dichloromethane. The clearance of 14C radioactivity from lungs occurred in two phases. The initial, more rapid phase of lung clearance of both particle-associated 14C radioactivity (Particle 14C) and extract-associated 14C radioactivity (Extract 14C) was very similar (t 1/2 approximately equal to 3 hr). However, the second phase of lung clearance of the remaining Particle 14C was much slower (t 1/2 approximately equal to 25 days) than the second phase of lung clearance of the Extract 14C (t 1/2 approximately equal to 2.9 days). Tracheal clearance rates of 14C radioactivity from both instillation studies were both rapid and similar (t 1/2 approximately equal to 10-12 hr). These results indicate that diesel engine exhaust particles reduce the lung clearance rate of the organic compounds associated with these particles. These studies also point to the possibility that the rate limiting step in the lung clearance of organic compounds associated with inhaled diesel exhaust particles may be the rate at which they dissociate from these particles in vivo. This is because the long-term clearance rate of the particle-associated organic compounds was shown here to be much slower than that of the same organic compounds in a particle-free form but not as slow as the lung clearance rate reported for diesel exhaust core particles (T.L. Chan, P.S. Lee, W.E. Hering, J. Appl. Toxicol. 1, 77-82 (1981)).

50642 **Mutagenic activity of nitrosamines in mammalian cells: Study with the CHO/HGPRT and human leukocyte SCE assays.** Ho, T.; Hsie, A.W.; San Sebastian, J. (Oak Ridge National Lab., Oak Ridge, TN). pp 129-147 of Genotoxicology of N-nitroso compounds. Rao, T.K.; Epler, J.L.; Lijinsky, W. New York, NY, USA; Plenum Press (1984).

This chapter examines the ability of eight nitrosamines to induce gene mutation at the hypoxanthine-guanine phosphoribosyl transferase (HGPRT) locus in Chinese hamster ovary (CHO) cells (the CHO/HGPRT assay). The induction of sister-chromatid exchanges (SCE) by nitrosopiperidine (NPIP) and nitrosopiperazines (NPZ) and their derivatives in a human leukocyte culture system is investigated. The correlation between the mutagenicity and carcinogenicity of these nitrosamines is discussed. It is determined that the potent mutagens nitrosodimethylamine and nitrosodiethylamine are strong carcinogens, and the moderate mutagens nitrosomorpholine, nitrosopyrrolidine, and dinitrosohomopiperazine exhibit moderate carcinogenicity. High correlation appears to exist between CHO/HGPRT mutagencity and animal carcinogenicity both qualitatively and quantitatively, and the correlation between animal carcinogenicity and SCE induction also appears to be good.

50643 **The relationship between the carcinogenicity and mutagenicity of nitrosamines in a hepatocytemediated mutagenicity assay.** Jones, C.A.; Huberman, E. (Argonne National Laboratory, Argonne, IL). pp 119-127 of Genotoxicology of N-nitroso compounds. Rao, T.K.; Epler, J.L.; Lijinsky, W. New York, NY, USA; Plenum Press (1984).

This chapter reports on the development of an hepatocyte-mediated mutagenesis system in which the mutagenicity of a series of nitrosamines would be related to their carcinogenic activity in vivo. Hepatocytes were prepared from adult male Fischer rats in order to metabolize the nitrosamines. Hepatocytes were cocultivated with the mutable V79 cells in the presence of nitrosamines, and mutations were characterized by resistance to ouabain and 6-thioguanine. The carinogenic nitrosamines were shown to be mutagenic in a dose-dependent manner. It is demonstrated that the use of intact hepatocytes to activate nitrosamines, coupled with appropriate mammalian target cells to indicate the genetic damage, represents a useful system for both detecting and establishing the mutagenicity of a series of nitrosamines in a manner corresponding to the carcinogenic potency produced by the same chemicals in vivo. It is concluded that mammalian cell-mediated mutagenesis assays constitute a valuable approach for the detection and evaluation of potentially carcinogenic chemicals in the environment.

50644 **Effects of pH and structure on the mutagenic activity of N-nitroso compounds.** Guttenplan, J.B. (New York Univ. Dental Center, New York, NY). pp 59-90 of Genotoxicology of N-nitroso compounds. Rao, T.K.; Epler, J.L.; Lijinsky, W. New York, NY, USA; Plenum Press (1984).

This chapter investigates the effects of pH on mutagenesis induced by N-nitroso compounds, and the effects of structural variations on mutagenesis induced by N-nitroso compounds and some of the possible reasons for these effects. Topics considered include alkylating properties, DNA repair, methods (liver extracts, mutagenesis assays, DMN demethylase), the effects of pH on mutagenesis and DNA alkylation by N-nitroso compounds, mutagenesis by N-nitroso-N'-nitroso-N-alkylguanidines, the repair of O_6methylguanine and its effect on mutagenesis, alternate mechanisms of mutagenesis by N-nitroso compounds, mutagenesis by a series of "weakly mutagenic" N-nitrosamines, and correlation between mutagenic potencies and carcinogenic activities of some N-nitroso compounds. It is determined that mutagenesis was enhanced to a greater extent at lower concentrations of mutagens, and with the exception of MEN and MBN, the relative increase in mutagenesis at a pH of 6.5 was smaller for the higher molecular weight compounds.

50645 **Structural basis for mutagenic activity of N-nitrosamines in the Salmonella histidine reversion assay.** Rao, T.K. (Oak Ridge National Lab., Oak Ridge, TN). pp 45-58 of Genotoxicology of N-nitroso compounds. Rao, T.K.; Epler, J.L.; Lijinsky, W. New York, NY, USA; Plenum Press (1984).

This chapter investigates the mutagenicity of a number of nitrosamines that have been characterized for carcinogenicity in rats using the Salmonella histidine reversion assay developed by Ames. The assay can be used to test chemicals that require a mammalian metabolic transformation by incorporating a tissue homogenate (usually rat liver S-9 with an NADPH-generating cofactor mix). Topics considered include the Salmonella typhimurium-histidine reversion assay (bacterial strains, mutagenesis assay, sources of nitrosamines) and mutagenesis studies in Salmonella typhimurium (mechanism of mutation induction by nitrosamines, relationship between chemical structure and mutagenic activity, nitrosamines as model compounds for mutagenesis studies). It is demonstrated that the availability of carcinogenicity data from nitrosamines makes them exceptionally useful in determining the empirical relationship between mutagens and carcinogens.

50646 **Effect of 3-aminobenzamide on the rate of ligation during repair of alkylated DNA in human fibroblasts.** Morgan, W.F.; Cleaver, J.E. (Univ. of California, San Francisco). *Cancer Research;* **43**: 3104-3107(Jul 1983). Contract AC03-76SF01012.

3-Aminobenzamide, an inhibitor of polyadenosine dephosphoribose polymerase, produced rapid reversible changes in single-strand break frequencies in DNA from primary human fibroblasts damaged by alkylating agents, but it did not cause such changes in the DNA of cells damaged by ultraviolet light. The increase in single-strand peak frequencies was not due to an accumulation of blocked repair sites, such as occurs with DNA polymerase inhibitors, but to a delay in the rejoining of induced breaks. 3-Aminobenzamide increases the net break frequency that results from a dynamic balance between excision and ligation. This balance appears to be regulated at the ligation step by adenosine diphosphate ribosylation, which is rapidly altered by addition or removal of 3-aminobenzamide. The rapidity with which strand break frequencies change in the presence of 3-aminobenzamide implies that individual strand

breaks resulting from excision at any time after exposure have a lifetime of no more than about 30 min in the cell.

50647 **Mortality and air pollution: lessons from statistics.** Lipfert, F.W. (Brookhaven National Lab., Upton, NY). *Studies in Environmental Science;* 20: 175-184(1982). (CONF-820526—). Contract AC02-76CH00016.

From 15. international colloquium on polluted atmospheres; Paris, France (4 May 1982).

This paper reviews cross sectional studies which attempt to link persistent geographic differences in mortality rates with air pollution. Some early studies are mentioned and detailed results are given for seven major contemporary studies, two of which are still in the publication process. Differences among the studies are discussed with regard to statistical techniques, trends in the results over time (1959-1974), and interpretation and use of the results. The analysis concludes that there are far too many problems with this technique to allow causality to be firmly established, and thus the results should not be used for cost benefit or policy analysis.

50648 **Comparative ozone dose response of gas exchange in a ponderosa pine stand exposed to long-term fumigations.** Coyne, P.I.; Bingham, G.E. (Dept. of Agriculture, Beltsville, MD). *Journal of the Air Pollution Control Association;* 31: No. 1, 38-41(Jan 1981). Contract W-7405-ENG-48.

Photosynthesis (by $^{14}CO_2$ uptake) and stomatal conductance of attached ponderosa pine (Pinus ponderosa Laws.) needles were studied in relation to cumulative incident ozone dose in a stand of sapling trees in the San Bernardino National Forest. Nine trees were stratified into three chronic injury classes (I, slight; II, moderate; III, severe) of three trees each, based on morphological O_3 injury symptoms, and the trees were sampled monthly from May to October of 1977. Although these three injury classes grew in a similar environment, they had differential photosynthetic and stomatal responses, suggesting ecotypic variation in O_3 sensitivity. The decline in photosynthesis and stomatal function normally associated with aging was accelerated as O_3 injury symptoms increased. Stomatal conductances tended to be somewhat larger in the more O_3-sensitive trees during July and August, when the needles were rapidly expanding and possibly most vulnerable to the high O_3 concentrations occurring during this period of the year. The relationship in conductances among injury classes reversed after the initial season of needle growth, primarily because stomatal function recovery during the relatively O_3-free winter months was inversely related to O_3 injury. In all trees and needle ages, losses in photosynthetic capacity exceeded reductions in stomatal conductance, suggesting that injury to the mesophyll, carboxylation, or excitation components of the CO_2 diffusion pathway was greater than injury to the stomatal.

50649 **Effects of sulfur dioxide on expansion of lesions caused by Corynebacterium nebraskense in maize and by Xanthomonas phaseoli var. sojensis in soybean.** Laurence, J.A.; Aluisio, A.L. (Cornell Univ., Ithaca, NY). *Phytopathology;* 71: No. 4, 445-448(1981). Contract AC02-77EV04368.

In order to assess the effects of air pollution on plant disease development, the authors investigated the effects of SO_2 on lesion development by two bacterial pathogens. Maize or soybean plants were exposed to sulfur dioxide (SO_2) at 524 $\mu g\ m^{-3}$ or 262 $\mu g\ m^{-3}$ before, after or before and after inoculation with Corynebacterium nebraskense or Xanthomonas phaseoli var. sojensis, respectively. Lesion development was inhibited in both cases, regardless of when the exposures occurred. The time of exposure, however, altered the subsequent effect on lesion size. Dry weight and sulfur content of host tissue were not altered by the joint effects of the pollutant and the pathogens.

50650 **Lead uptake by perennial ryegrass and radishes from air, water and soil.** Ter Haar, G.L.; Dedolph, R.R.; Holtzman, R.B.; Lucas, H.F. Jr. (Argonne National Lab., IL). *Canadian Veterinary Journal;* 16: No. 9, 260-264(1975).

Grass and radishes were grown in a specially constructed growth chamber with either normal or filtered air, while either distilled or lead-containing water was applied either to the leaves or to the soil surface. The experimental design was randomized complete block with factorial arrangement of treatments while the results were analyzed by the associated analysis of variance technique. The lead content of grass grown in filtered air was 2.5 $\mu g/g$ while that grown in unfiltered air was 5.2 $\mu g/g$. These values are different at the 1% level of significance. The uptake of lead from the water applied either to the foliar parts or to the soil surface was not significant at the 5% level. The lead concentration of either radish leaves or edible parts did not differ greatly for any treatment at the 5% level, and was the same as for grass grown in filtered air. These measurements indicate that half of the lead content of grass and nearly all of that in radishes was obtained from the soil with little adsorption from simulated rainfall.

50651 **Effects of air pollutants on plant cell tissue cultures.** Columbus, OH, USA; Battelle Memorial Institute (1967). 5p.

Experiments were conducted to determine morphological and physiological effects of air pollutants on plant tissue cultures. Several cultures will be exposed to polluted atmospheres for various periods and observed for effects. The cultures which have been developed for this purpose are: tobacco pith, rose stem, soybean stem, periwinkle, and morning glory. Exposures will follow two regimens: a relatively high concentration of pollutant for a short duration and a low concentration for a long duration. Effects of pollutants on cell morphology will be observed microscopically. Effects on cell physiology may include altered respiratory quotients which will be determined by Warburg respirometry techniques. The design of an apparatus that is being developed to mix a pollutant with air and deliver it to the cultures is described.

5604 Other Environmental Pollutant Effects

50652 **(NP—5900034) Effects of electromagnetic fields produced by high voltage transmission lines. Final report.** Young, T. (Legislative Science Office, Lansing, MI (USA)). Jun 1984. 73p. NTIS, PC A04/MF A01. File Number DE85900034.

Electric utilities have continued to develop and implement higher transmission line voltages. The impetus for this trend is the greater efficiency and smaller right-of-way required (per unit of energy transported) for these higher voltage lines. A significant amount of research has been conducted to determine the potential impacts of these lines on people, animals, and plants. In many cases the results of these studies have, for various reasons conflicted with one another. This report reviews, summarizes and attempts to reconcile the differences among these studies. Although there are some obvious dangers posed by transmission line operation, construction, and maintenance, most of these concerns have been addressed by safty measures taken by utility companies. It is the more indirect effects of power transmission with which this report is concerned. The report covers three major categories of field effects: corona effects (due to the electric field at the conductor's surface), indirect coupling effects (arising from induced currents in nearby conducting objects), and direct coupling effects (caused by induced currents in organisms). 86 references, 12 figures, 12 tables.

50653 **(OEFZS—4268) Radiation protection problems by nonionizing electromagnetic radiation in Austria.** Duftschmid, K.E. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). Mar 1984. 18p. (ST—112/84). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703141.

For about one year an interdisciplinary study group has been established to investigate possible radiation protection problems caused by nonionizing electromagnetic radiation in this country. The aim of this project is to identify major fields of concern, to establish appropriate techniques of measurement and control and eventually develop a sound basis for future legislation. The paper gives a summary on the present results of this study.

58 GEOSCIENCES

50654 (DOE/ER—0145/2) Summaries of physical research in the geosciences. (USDOE Office of Energy Research, Washington, DC. Engineering, Mathematics and Geosciences Div.). Sep 1984. 161p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE85001882.

The summaries in this document describe the scope of the individual programs and detail the research performed during 1983-1984. The Geosciences Research Program includes research in geology, petrology, geophysics, geochemistry, hydrology, solar-terrestrial relationships, aeronomy, seismology, and natural resource analysis, including their various subdivisions and interdisciplinary areas.

5801 Geology And Hydrology

REFER ALSO TO CITATION(S) 58010049561, 49596, 50270, 50352

50655 (CONF-8404170—5) Impacts of bioturbation on the age difference between benthic and planktonic foraminifera in deep sea sediments. Peng, T.H.; Broecker, W.S. (Oak Ridge National Lab., TN (USA); Columbia Univ., Palisades, NY (USA). Lamont-Doherty Geological Observatory). 1984. Contract AC05-84OR21400. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85000905.

From 3. international symposium on acceleration mass; Zurich, Switzerland (10 Apr 1984).

Accelerator mass spectrometry offers for the first time the opportunity to date hand-picked planktonic (surface-swelling) and benthic (bottom-dwelling) foraminifera from deep sea cores, making it possible to reconstruct temporal changes in the rate of deep ocean ventilation. There is, however, a serious problem in interpreting such results. Bioturbation of the soil zone in the upper has two subtle influences that lead to biases in the results. One involves changes with time in the abundances of the forams in newly deposited sediment. The other concerns dissolution effects on the forams during their residence within the bioturbated layer. Mixing models are presented in this paper that illustrate the effects of these interactions on the ^{14}C age difference between benthic and planktonic species. 9 references, 12 figures.

50656 (GSF-R—296) Institute of Radiohydrometry annual report 1981. Moser, H.; Neumaier, F.; Baker, D.R.; Batsche, H.; Behrens, H.; Drost, W.; Escher-Vetter, H.; Hefka, R.; Oerter, H.; Rauert, W. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Radiohydrometrie). Jul 1982. 173p. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number DE84751508.

The report presents findings of current research on apparative and methodological developments (T, ^{14}C and ^{85}Kr concentrations), fundamentals of isotope hydrology and geohydrology, water chemistry analyses, methods applied (single-borehole method), and tracer measurements.

50657 (IAEA-TECDOC—298) Radioisotopes in sediment studies. Report of a consultants' group meeting organized by the IAEA and held in Vienna, 13-17 December 1982. (International Atomic Energy Agency, Vienna (Austria)). Oct 1983. 77p. (CONF-821284—). NTIS (US Sales Only), PC A05/MF A01. File Number DE84780553.

From IAEA meeting on radioisotopes in sediment studies; Vienna, Austria (13 Dec 1982).

Items within the scope of EDB have been entered individually into the data base. (ACR)

50658 (INIS-mf—9040, pp 53-56) **Identification and characterization of major structural discontinuities within the Eye-Dashwa lakes granite, Atikokan, N.W. Ontario.** Brown, P.A.; Rey, N.A.C. (Atomic Energy of Canada Ltd., Ottawa, Ontario). 1982. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780568. (CONF-820933—Summs.).

From International conference on radioactive waste management; Winnipeg, Manitoba, Canada (12 Sep 1982).

Published in summary form only.

50659 (INIS-mf—9069) Sedimentology 82: Abstracts. Sedimentology applied to exploration, mining, engineering and environmental studies. (Geological Society of South Africa, Johannesburg). 1982. 133p. (CONF-8209246—Absts.). NTIS (US Sales Only), PC A07/MF A01. File Number DE85780057.

From 3. symposium of the Sedimentological Division of the Geological Society of South Africa; Johannesburg, South Africa (13 Sep 1982).

Separate abstracts have been prepared for items within the scope of the Energy Data Base.

50660 (NP—4901865) Carbonate bodies within the basal swift formation (Jurassic) of northwestern North Dakota. Report of investigation No. 81. Langtry, T.M. (North Dakota Geological Survey, Grand Forks (USA)). 1983. 147p. North Dakota Geological Survey, University Station, Grand Forks, ND 58202. File Number TI84901865.

The carbonate bodies of the basal Swift Formation (Upper Jurassic) occur as anomalous deflections on a relatively uniform mechanical well-log section. The areal distribution, stratigraphic relationships, and genesis of the carbonate bodies were determined using the gamma-ray log, the spontaneous-potential log, the resistivity log suite, and megascopic and microscopic core analysis. The carbonate bodies of the basal Swift Formation were found to be coarsening-upward sequences composed of predominantly sand-sized, recrystallized mollusk grains. These grains were transported by strong bottom currents across the irregular sea floor of the shallow epicontinental Jurassic sea, and were deposited under agitated water conditions in the offshore environment. These carbonate sand bodies are analogous to offshore-bar deposits of similar age that are recognized across the midcontinent region. The shape of the carbonate bodies, their high moldic porosity and good permeability of the grainstones, coupled with the seal provided by the overlying shale, makes these basal Swift carbonate bodies good reservoir rocks. The shallow depth of burial and the thermal immaturity of the surrounding shales makes it unlikely that thermally generated hydrocarbons will be found in the carbonate bodies. However,the possibility of the existence of biogenic gas, derived from the surrounding shales, makes these deposits potential sites for exploration. 66 references, 32 figures, 4 tables.

50661 (TVA/ONRED/AWR—84/21) Floods on Duck River in the vicinity of Centerville, Tennessee. (Tennessee Valley Authority, Knoxville (USA). Office of Natural Resources and Economic Development). Jul 1984. 76p. NTIS, PC A05/MF A01. File Number DE84901970.

This flood hazard information report describes the extent and severity of the flood potential along a selected reach of the Duck River in the vicinity of Centerville, Tennessee. The report was prepared in response to a request by the town for up-to-date information regarding the flood potential along the studied stream reach in order to better administer its floodplain management program. This report does not propose plans or the solution of identified flood problems along the studied stream reach. Rather, the information and technical data contained herein are intended to provide a sound basis for informed decisions regarding the wise use of flood-prone lands within the town of Centerville and the surrounding portion of Hickman County. 3 references, 8 figures, 6 tables.

50662 Compound structural history of Sweetgrass arch, northwestern Montana. Lorenz, J.C. (Sandia National Laboratories, Albuquerque, NM). *American Association of Petroleum Geologists, Bulletin;* **67**: No. 8, 1348(Aug 1983). (CONF-8309274—).

From AAPG Rocky Mountain Section meeting; Billings, MT, USA (18 Sep 1983).

The present form of the Sweetgrass arch is the cumulative produce of a geologic history which began in the late Precambrian. At that time, the area of the arch formed the eastern limit for the belt strata, which were deposited on the Precambrian continental shelf. These thick (40,000 ft, 12 km) deposits depressed the underly-

ing lithosphere sufficiently to cause a mild upwarping at the adjacent shelf hingeline, the area of the arch. During the Paleozoic, the arch was a relative high between the Williston basin to the east and continued shelf sedimentation to the west, and the arch was mildly uplifted in Walcott's 1970 process of amplified topography. With the formation of the Sevier overthrust belt in Late Jurassic time, this ancestral arch provided a susceptible area at an optimum distance for the formation of a forebulge on an elastically flexed lithosphere. This forebulge (the arch) was mildly uplifted in response to the supracrustal loads created to the west by overthrusting. Although uplift events at the arch can be tentatively correlated with thrust events in the eastward migrating overthrust belt, the arch remained stationary, and the load to forebulge distance did not remain constant as flexural theory would predict. This was probably caused by early curvature at the arch in excess of elastic limits, creating brittle and plastic components in the local lithosphere, which thus became more susceptible to flexure than the adjacent areas, localizing the arch. With the onset of the Laramide orogeny, involving basement as well as thin-skinned tectonics, horizontal compressive forces tightened and significantly uplifted the existing arch.

50663 **Laramide interactions of structural elements in southwestern Montana.** Lorenz, J.C. (Sandia National Laboratories, Albuquerque, NM). *American Association of Petroleum Geologists, Bulletin;* 67: No. 8, 1348-1349(Aug 1983). (CONF-8309274—).

From AAPG Rocky Mountain Section meeting; Billings, MT, USA (18 Sep 1983).

The present geologic framework of southwestern Montana is the result of the interactions of several structural units during the Laramide orogeny. The Lewis and Clark lineament is the oldest of these, having been in existence since the Precambrian when some of its elements bounded the Belt embayment. It is composed of five or six parallel features with differing geologic histories. During the Laramide orogeny, horizontal compression initiated deep-seated wrench faulting along the Lewis and Clark lineament. This faulting allowed the transition from the continued Sevier style of thin-skinned overthrust deformation, which occurred north of the lineament, to the foreland basement-involved thrust deformation, which occurred to the south. The differential motion of the basement was absorbed by small amounts of left-lateral transform motion. This lineament may also have created a weak zone in the crust into which the boulder batholith intruded during the early stages of the Laramide. The voluminous volcanic material associated with the batholith created a supracrustal load which downwarped the adjacent lithosphere. If the batholith itself slid eastward, as advocated by Hyndman in 1979, the load was enhanced. Decoupling of the lithosphere along the southern most elements of the Lewis and Clark lineament localized and accentuated the load-induced subsidence, creating the Crazy Mountains basin and localizing the accumulation of the thick volcaniclastic sediments of the Livingston Group.

5802 Geophysics

REFER ALSO TO CITATION(S) 58020049723, 50662

50664 **(PB—84-212711) Geophysical methods for locating abandoned wells.** Frischknecht, F.C.; Muth, L.; Grette, R.; Buckley, T.; Kornegay, B. (Geological Survey, Denver, CO (USA)). Jul 1984. 228p. NTIS, PC A11/MF A01.

A preliminary study of the feasibility of using geophysical exploration methods to locate abandoned wells containing steel casing indicated that magnetic methods promise to be effective and that some electrical techniques might be useful as auxiliary methods. Ground magnetic measurements made in the vicinity of several known cased wells yielded total field anomalies with peak values ranging from about 1,500 to 6,000 gammas. The anomalies measured on the ground are very narrow and, considering noise due to other cultural and geologic sources, a line spacing on the order of 50 feet (15.2m) would be necessary to locate all casings in the test area.

5803 Mineralogy, Petrology, And Rock Mechanics

REFER ALSO TO CITATION(S) 58030049450, 49451, 49538, 49560, 50659

50665 **(BMI/ONWI—550) Transient creep of repository rocks. Mechanistic creep laws for rock salt. Final report.** Handin, J.; Russell, J.E.; Carter, N.L. (Texas A and M Univ., College Station (USA). Research Foundation). Sep 1984. Contract AC02-83CH10140. 173p. NTIS, PC A08/MF A01; GPO Dep. File Number DE85000788.

We have tested 10 by 20-cm cores of Avery Island rocksalt in triaxial compression at confining pressure of 3.4 and 20 MPa, temperature of 100°C, 150°C, and 200°C, and constant strain rates of 10^{-4}, 10^{-5}, and $10^{-6}s^{-1}$. Neglecting the small effect of confining pressure, we have fit our data to a semi-empirical constitutive model that relates differential stress to strain, strain rate, and absolute temperature. This model rather well predicts the results of relaxation (nearly constant strain) tests as well as constant-stress-rate and constant-stress (creep) tests. Furthermore, even though stress-strain curves reflect the strain hardening that corresponds to transient creep, our model also predicts the steady-state flow stresses measured in creep tests under comparable conditions. Comparing the response of coarse-grained (8 mm) natural rocksalt, fine-grained (0.3 mm) synthetic aggregates, and halite single crystals has revealed that although the effect of grain size alone is small, the influences of substructure (e.g., subgrain size and dislocation density) and impurities (especially brine) may well be large and certainly deserve further investigation.

50666 **(DOE/ER/12099—T1) Physical characterization of magma. Progress report.** Manghnani, M.H. (Hawaii Univ., Honolulu (USA)). 1984. Contract AT03-82ER12099. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000568.

Progress is reported in the following research areas: (1) elastic and anelastic properties of basalt melts; (2) electrical conductivity of Kilauea Iki samples; and (3) physical and thermal properties. (ACR)

5804 Geochemistry

REFER ALSO TO CITATION(S) 58040049494

50667 **(PNL-SA—12442) Validation of geochemical models.** Jenne, E.A.; Krupka, K.M. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1984. Contract AC06-76RL01830. 10p. (CONF-8406134—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000356.

From Workshop on fundamental geochemistry needs for nuclear waste isolation; Los Alamos, NM, USA (20 Jun 1984).

The following aspects of geochemical model validation are discussed: definition of terms; the approach; validation studies; and limitations. 10 references.

5805 Oceanography

REFER ALSO TO CITATION(S) 58050050581

50668 **(PINSTECH/RIAD—105) Preparation of radioactive tracer for studying sediment movement.** Hussain, S.D.; Ghauri, G.A.; Qureshi, M.H.; Khan, N.A. (Pakistan Inst. of Nuclear Science and Technology, Rawalpindi. Radiation and Isotope Applications Div.). Jun 1983. 25p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703126.

In order to study the movement of sediment in harbours, estuaries and streams, artificial sediment in the form of glass is prepared. A preselected nuclide is added to the glass during its manufacture. The density and size distribution of the glass particles is similar with that of the natural sediment. The activation of the artificial sediment in a reactor changes the nuclide into a radioactive isotope thereby tagging it and making it possible to trace its movement with a suitable radiation detector. The method of tracer prep-

aration is described with special reference to sediment movement studies at Karachi harbour.

64 PHYSICS. I.

REFER ALSO TO CITATION(S) 64000050817

6401 Astrophysics And Cosmology

REFER ALSO TO CITATION(S) 64010050755, 50976

50669 (DOE/ER/40008—61) Supersymmetric inflationary cosmology. Holman, R. (Florida Univ., Gainesville (USA). Dept. of Physics). 1984. Contract AS05-81ER40008. 10p. (CONF-8405155—4). NTIS, PC A02/MF A01; GPO Dep. File Number DE85001331.

From Inner space/outer space conference; Batavia, IL, USA (2 May 1984).

We use N=1 supergravity coupled to hidden sectors to construct a completely viable inflationary scenario. Contraints on the gravitino abundance allow us to predict that (delta rho/rho) gal $\sim 10^{-4}$ as required for galaxy formation.

50670 (INIS-mf—9064, pp 78) Future of cosmic ray physics. McCusker, C.B.A. (Sydney Univ. (Australia). School of Physics). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50671 (INIS-mf—9064, pp 79) Composition of cosmic radiation for energies of more than 100 TeV. Winn, M.M. (Sydney Univ. (Australia). School of Physics). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50672 (ISAS—47-83/EP) Quark hadron phase transition in bianchi type I cosmologies. Giannetto, E.; Salucci, P. (International School for Advanced Studies, Trieste (Italy)). 1983. 8p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703110.

The "cosmological" quark hadron phase transition and its consequences on the following evolution are investigated in an anisotropic framework.

50673 (KFKI—1983-109) Proposal for electron beam induced remote sensing x-ray fluorescence investigation of minor bodies in the solar system. Experiment IND-X. Hrehuss, G.; Gombosi, T.I.; Naday, I.; Pogany, L.; Szegoe, K. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Nov 1983. 28p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84703109.

The composition of the surface material of minor bodies in the solar system can be measured using a semiconductor soft x-ray spectrometer mounted on the space probe. The characteristic x-rays are excited by a 20 kV low current electron beam of a space-born electron gun. After the description of the main features of the technique, estimations on its sensitivity, supported by a model experiment, are given. The minimum fly-by distance to apply this method can be estimated as a few kilometers.

50674 (LA-UR—84-2989) X-ray emission from Centaurus A. Terrell, J. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 4p. (CONF-840796—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002030.

From X-Ray and UV lemission from active galactic nuclei conference; Carching, F.R. Germany (9 Jul 1984).

The X-ray strength of Cen A (NGC 5128) was monitored for 10 years by Vela 5B, beginning in 1979. The 1973 to 1975 period of exceptional activity and strength was especially well covered, and was characterized by numerous rapid changes in intensity, in agreement with other data, indicating that the nucleus of Cen A is small but massive. 16 references, 3 figures.

50675 (LBL—18271) Evidence for a solar companion star. Muller, R.A. (Lawrence Berkeley Lab., CA (USA)). Aug 1984. Contract AC03-76SF00098. 14p. (CONF-8406203—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002069.

From 112. international Astronomical Union symposium on the search for extraterrestrial life: recent developments; Boston, MA, USA (18 Jun 1984).

Periodicity seen in both the mass extinctions and large impact cratering on earth can be explained if one postulates that the sun has a companion star, orbiting in a moderately eccentric orbit with a major axis of 2.8 light-years. No other explanations that have been suggested are compatible with known facts of physics and astronomy. If the companion is a red dwarf star, the most common kind in the galaxy, then no previous astronomical observations would have found it. A search for red objects with large parallax is now underway at Berkeley, and has a good chance of identifying the star in the near future.

50676 (N—84-24661) High-resolution study of ultraheavy cosmic-ray nuclei (A0178). Osullivan, D.; Thompson, A. (Dublin Inst. for Advanced Studies (Ireland)). Feb 1984. 4p. NTIS, PC A09/MF A01.

The main objective of the experiment is a detailed study of the charge spectra of ultraheavy cosmic-ray nuclei from zinc (Z 30) to uranium (Z 92) and beyond using solid-state track detectors. Special emphasis will be placed on the relative abundances in the region Z or - 65, which is thought to be dominated by r-process nucleosynthesis. Subsidiary objectives include the study of the cosmic-ray transiron spectrum a search for the postulated long-lived superheavy (SH) nuclei (Z or 110), such as (110) SH294, in the contemporary cosmic radiation. The motivation behind the search for super-heavy nuclei is based on predicted half-lives that are short compared to the age of the Earth but long compared to the age of cosmic rays. The detection of such nuclei would have far-reaching consequences for nuclear structure theory. The sample of ultraheavy nuclei obtained in this experiment will provide unique opportunities for many tests concerning element nucleosynthesis, cosmic-ray acceleration, and cosmic-ray propagation.

50677 (N—84-24662) Heavy ions in space (M0001). Adams, J.H. Jr.; Silberberg, R.; Tsao, C.H. (Naval Research Lab., Washington, DC (USA)). Feb 1984. 4p. NTIS, PC A09/MF A01.

The ojectives are to investigate three components of heavy nuclei in space: (1) a recently observed anomalous component of low-energy nuclei of N, O, and Ne (2) the heavy nuclei in the Van Allen radiation belts and (3) the UH nuclei (Z 30) of the galactic radiation. The study of the anomalous flux of N, O, and Ne nuclei in the unexplored energy region above 100 MeV/u is expected to provide new insights into the source of this component. Its observation in this experiment will confirm that these ions are singly charged. Knowledge of the energy spectra of the heavy nuclei observed in the Van Allen belts is expected to enhance the understanding of the origin of the belts (e.g., injection and local acceleration pocesses). The observation of these heavy ions could show, for the first time, that low-energy particles of extraterrestrial origin can diffuse to the innermost parts of the magnetosphere. Measurements of the UH component are expected to contribute information concerning its source, interstellar propagation, and the galactic storage time.

50678 (N—84-24664) Measurement of heavy cosmic-ray nuclei on LDEF (M0002-2). (Kiel Univ. (Germany, F.R.)). Feb 1984. 2p. NTIS, PC A09/MF A01.

The objective of this experiment is to measure the elemental and isotopic abundamces of heavy cosmic-ray nuclei with nuclear charge Z equal to or greater than 3. The chemical and energy spectra will be measured for particles that have energies in the range from 20 to 1000 MeV per atomic mass unit. Two points of great interest are geomagneticaly forbidden cosmic-ray particles and heavy ions of the trapped radiation.

50679 **(N—84-24665) Linear energy transfer spectrum measurement experiment (P0006).** Benton, E.V.; Parnell, T.A. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center). Feb 1984. 2p. NTIS, PC A09/MF A01.

The linear energy transfer (LET) is the energy deposited per unit path length of charged particle traversing matter. For estimating the rate of damage from single-hit phenomena, the quantity that best combines the radiation environment, orbital situation, and spacecraft shielding is the linear energy transfer (LET) spectrum at the device location. This experiment will measure the LET spectrum behind different shielding configurations for approxmately 1 year. The shielding will be increased in increments of approximately 1 G/sq cm up to a maximum shieldng of 16 G/sq cm. In addition to providing critical information to future spacecraft designers, these measurements will also provide data that will be extremely valuable to other experiments on LDEF.

50680 **(N—84-24670) Chemical and isotopic measurements of micrometeoroids by secondary ion mass spectrometry (A0187-2).** Foote, J.H.; Swan, P.D.; Walker, R.M.; Zinner, E.K.; Bahr, D.; Fechtig, H.; Jessberger, E.; Igenbergs, E.; Kreitmayr, U.; Kuczera, H. (McDonnell Center for Space Sciences, St. Louis, MO (USA)). Feb 1984. 5p. NTIS, PC A09/MF A01.

The objective of this experiment is to measure the chemical and isotopic composition of interplanetary dust particles of mass greater than 10 to the minus 10 power G for most of thermator elements expected to be present.

50681 **(N—84-24684) Passive exposure of Earth radiation budget experiment components (A0147).** Hickey, J.R.; Griffin, F.J. (Eppley Lab., Inc., Newport, RI (USA)). Feb 1984. 3p. NTIS, PC A09/MF A01.

In-flight calibration for the solar and Earth flux channels was examined. Earth Radiation on Budget (ERB) channel components were exposed to the space environment and then retrieved and resubmitted to radiometric calibration after exposure. It is suggested that corrections may be applied to ERB results and information will be obtained to aid in the selection of components for future operational solar and Earth radiation budget experiments. To assure that these high accuracy devices are measuring real variations and are not responding to changes induced by the space environment, it is desirable to test such devices radiometrically after exposure to the best approximation of the orbital environment.

50682 **(N—84-25583) Acceleration of runaway electrons and Joule heating in solar flares.** Holman, G.D. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). May 1984. 38p. (NASA-TM—86112). NTIS, PC A03/MF A01.

The electric field acceleration of electrons out of a thermal plasma and the simultaneous Joule heating of the plasma are studied. Acceleration and heating timescales are derived and compared, and upper limits are obtained on the acceleration volume and the rate at which electrons can be accelerated. These upper limits, determined by the maximum magnetic field strength observed in flaring regions, place stringent restrictions upon the acceleration process. The role of the plasma resistivity in these processes is examined, and possible sources of anomalous resistivity are summarized. The implications of these results for the microwave and hard X-ray emission from solar flares are examined.

50683 **(N—84-25585) Observations of He+ ions in the solar wind.** Pissarenko, N.F.; Dubinin, E.M.; Zakharov, A.V.; Budnik, E.Y.; Lundin, R. (Kiruna Geofysiska Inst. (Sweden)). Feb 1984. 20p. (KGI—064). NTIS, PC A02/MF A01.

Results obtained from the PROGNOZ-8 ion composition experiment which indicates that He(+) ions may be more abundant in the solar wind than previous measurements have indicated. The experiment has a sufficiently high mass resolution to accurately discriminate between H(+), He(++), He(+) and O(+) ions over the energy range 0.35 to 5.2 keV/e. Furthermore, the fact that the experiment is continuously monitoring in the solar direction means that fairly good statistics can be aquired as well. In a few cases, He(+)/He(++) ratios up to approximately 0.05 were found, but in most cases when He(+) was observed, it was generally of the order 0.3 to 3% of the He(++) content. The results were compared with previous measurements of He(+) ions in the solar wind and discuss also other constituents with M/q 4 as alternative candidates. Finally, a possible explanation for the high He(+) abundance in the disturbed solar wind is given.

50684 **(N—84-25587) High resolution hard X-ray spectra of solar and cosmic sources.** Schwartz, R.A. (California Univ., Berkeley (USA)). 1984. 118p. (NASA-CR—173561). NTIS, PC A06/MF A01.

High resolution hard X-ray observations of a large solar flare and the Crab Nebula were obtained during balloon flights using an array of cooled germanium planar detectors. In addition, high time resolution high sensitivity measurements were obtained with a 300 square cm NaI/CsI phoswich scintillator. The Crab spectrum from both flights was searched without finding evidence of line emission below 200 keV. In particular, for the 73 keV line previously reported a 3 sigma upper limit for a narrow (1 keV FWHM) line .0019 and .0014 ph square cm/sec for the 1979 and 1980 flights, respectively was obtained.

50685 **(N—84-26510) Application of a global solar wind/planetary obstacle interaction computational model: Earth, Venus, Mars, Jupiter, and Saturn studies.** Stahara, S.S. (Nielsen Engineering and Research, Inc., Mountain View, CA (USA)). May 1984. 11p. NTIS, PC A08/MF A01.

This work relates to a series of collaborative investigations involving the application of a computational model for the determination of the detailed plasma and magnetic field properties associated with the global interaction of the solar wind with various planetary obstacles throughout the solar system. The theoretical method is based on an established single fluid, steady, dissipationless, magnetohydrodynamic continuum model, and is appropriate for the calculation of supersonic, super-Alfvenic solar wind flow past planetary obstacles. The investigations undertaken relate to studies of various solar wind interaction phenomena with Venus, Earth, Jupiter, and Saturn.

50686 **(N—84-26515) Magnetic field of Mars: implications from gasdynamics modeling.** Russell, C.T.; Luhmann, J.G. (California Univ., Los Angeles (USA)). May 1984. 24p. NTIS, PC A08/MF A01.

On January 21, 1972 the Mars-3 spacecraft observed a variation in the magnetic field during its periapsis passage over the dayside of Mars that was suggestive of entry into a Martian magnetosphere. The original data and trajectory have been obtained to simulate the observed variation of the magnetic field using gasdynamics. In the gasdynamic model, a flow field is first generated and then this flowfield is used to carry the interplanetary magnetic field through the Martian magnetosheath. The independence of the flow field and magnetic field calculation allows rapid convergence on an IMF orientation which would result in a magnetic variation similar to that observed by Mar-3. There appears to be no need to invoke an entry into a Martian magnetosphere to explain these observations.

50687 **(N—84-26550) Acceleration and confinement of energetic particles in the 7 June 1980 solar flare.** Kane, S.R.; Kai, K.; Kosugi, T.; Enome, S.; Landecker, P.B. (Aeronautical Research Labs., Melbourne (Australia)). Aug 1983. 42p. (NASA-CR—173545). NTIS, PC A03/MF A01.

Pulsations with large amplitude and duration were observed during the hard X-ray and microwave radio bursts associated with the solar flare. High time resolution measurements of 20 to 800 keV X-rays were made with the X-ray spectrometers aboard ISEE-3 and the P-78-1 spacecraft. Radio measurements, covering metric to microwave wavelengths, were made at the Nobeyama and Toyokawa observatories in Japan. The temporal evolution of the X-ray and the radio spectra and the polarization and spatial structure of the microwave source were examined. The following interpretation is found to be consistent with the observations: the variations in the electron acceleration/injection spectrum are responsible for the observed variations in the hard X-ray and microwave

emissions and the locations of the hard X-rays and microwave sources are probability different, the X-ray source being located at a lower altitude.

50688 **(N—84-26551) Timing analysis of hard X-ray emission and 22 GHz flux and polarization in a solar burst.** Costa, J.E.R.; Kaufmann, P.; Takakura, T. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). May 1984. 22p. (INPE—3103-PRE/502). NTIS, PC A02/MF A01.

A solar flare occurring on 26 February 1981 at 1932 UT was observed simultaneously in hard X rays and microwaves with a time resolution of a fraction of a second. The X ray observations were made with the Hard X ray Monitor on Hinotori, and the microwave observations were made at 22 GHz with the 13.7m Itapetinga mm-wave antenna. Timing accuracy was restricted to 62.5 ms, the best time resolution obtained in hard X rays for this burst. The principal results are the following: (1) all 22 GHz flux structures were delayed by 0.2 to 0.9 second relative to similar structures in hard X rays throughout the burst duration (2) different burst structures showed different delays, suggesting that they are independent of each other (3) the time structures of the degree of polarization at 22 GHz precede the total microwave flux time structures by 0.1 to 0.5 sec (4) plots of time delays against time obtained every 125 ms for microwaves relative to hard X rays, and for microwave polarization degree relative to total microwave flux show fluctuations which are not clearly correlated to any of the other time structures.

50689 **(N—84-26554) Coalescence of two pressure waves associated with stream interactions.** Whang, Y.C.; Burlaga, L.F. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Apr 1984. 34p. (NASA-TM—86120). NTIS, PC A03/MF A01.

An MHD unsteady 1-D model is used to simulate the interaction and coalescence of two pressure waves in the outer heliosphere. Each of the two pressure waves was a compression region bounded by a shock pair. Computer simulation using Voyager data as input demonstrates the interaction and coalescence process involving one pressure wave associated with a fast stream and the other pressure wave without a fast stream. The process produced a significant change in the magnetic field and plasma signatures. The propagation of the forward and reverse shocks first widened the radial dimension of the shock compression region with increasing heliocentric distances. The shocks belonging to two neighboring compression regions eventually collided and two compression regions began to overlap with each other. This type of interaction is a dominant dynamical process in the outer heliosphere, and significantly and irreversible alters the structure of the medium.

50690 **(N—84-26557) Extragalactic radio sources.** Sturrock, P.A. (Stanford Univ., CA (USA)). Apr 1984. 21p. (NASA-CR—173606). NTIS, PC A02/MF A01.

The standard model for extragalactic variable radio sources comprises an isotropically expanding plasmoid with frozen magnetic flux and an electron distribution which evolves adiabatically. This model leads to the following relaton between the peak luminosity L (sub nu, m) and the relevant frequency nu(sub m) which are functions of time: L(sub nu,m) is proportional to nu(sub m)(n) where N (7n + 5)/(4n + 5). In this expression, n is the spectral index in the optically thin part of the spectrum, where L (sub nu) is proportional to nu (-n). For n in the range 0.5 to 1.5, the standard model yields N in the range 1.2 to 1.4. By contrast, analysis of observational data yields estimates of N in a small range about the mean value 0.4, in clear contradiction with the standard model.

50691 **(N—84-26558) Limits on soft X-ray flux from distant emission regions.** Burrows, D.N.; Mccammon, D.; Sanders, W.T.; Kraushaar, W.L. (Wisconsin Univ., Madison (USA)). May 1984. 38p. (NASA-CR—173591). NTIS, PC A03/MF A01.

The all-sky soft X-ray data of McCammon et al. and the new N sub H survey (Stark et al. was used to place limits on the amount of the soft X-ray diffuse background that can originate beyond the neutral gas of the galactic disk. The X-ray data for two regions of the sky near the galactic poles are shown to be uncorrelated with 21 cm column densities. Most of the observed x-ray flux must therefore originate on the near side of the most distant neutral gas. The results from these regions are consistent with X-ray emission from a locally isotropic, unabsorbed source, but require large variations in the emission of the local region over large angular scales.

50692 **(N—84-26559) Hard X-ray and microwave morphology.** Petrosian, V. (Stanford Univ., CA (USA)). Feb 1984. 39p. (NASA-CR—173568). NTIS, PC A03/MF A01.

An in depth analysis of data (and comparison with observation) from SMM and Hinotori on the Hard X-ray and Microwave Morphology of the flares was conducted.

50693 **(N—84-26560) Nuclear processes in the jets of SS433.** Ramaty, R.; Kozlovsky, B.; Lingenfelter, R.E. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). May 1984. 15p. (NASA-TM—86109). NTIS, PC A02/MF A01.

The very narrow gamma-ray lines observed at 1.495 and 6.695 MeV from SS433 which are blueshifted 1.369 and 6.129 emissions from deexcitations of (24)Mg* and (16)O* in grains moving with the jets and inelastically excited by interactions with the ambient medium are discussed. Energetic particle interactions in grains produce very narrow gamma ray lines from deexcitation of nuclear levels whose lifetimes are long enough that the excited nuclei stop before deexcitation. The presence of grains in the jets resolves hitherto discussed difficulties of inelastic excitation models for gamma ray production in SS433, the very narrow widths of the observed lines and the absence of other strong lines, expected from abundant elements. A model is proposed which could be distinguished from a previously proposed fusion model by gamma ray line observations.

50694 **(N—84-26561) Cosmic rays and the emission line regions of active galactic nuclei.** Ferland, G.J.; Mushotzky, R.F. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). May 1984. 54p. (NASA-TM—86110). NTIS, PC A04/MF A01.

The effects that the synchrotron emitting relativistic electrons could have on the emission line regions which characterize active nuclei are discussed. Detailed models of both the inner, dense, broad line region and the outer, lower density, narrow line region are presented, together with the first models of the optically emitting gas often found within extended radio lobes. If the relativistic gas which produces the synchrotron radio emission is mixed with the emission line region gas then significant changes in the emission line spectrum will result. The effects of the synchrotron emitting electrons on filaments in the Crab Nebula are discussed in an appendix, along with a comparison between the experimental calculations, which employ the mean escape probability formalism, and recent Hubbard and Puetter models.

50695 **(N—84-26562) TOPEX orbital radiation study.** Stassinopoulos, E.G.; Barth, J.M. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Apr 1984. 163p. (NASA-TM—85447; X—601-84-10). NTIS, PC A04/MF A01.

The space radiation environment of the TOPEX spacecraft is investigated. A single trajectory was considered. The external (surface incident) charged particle radiation, predicted for the satellite, is determined by orbital flux integration for the specified trajectory. The latest standard models of the environment are used in the calculations. The evaluation is performed for solar maximum conditions. The spacecraft exposure to cosmic rays of galactic origin is evaluated over its flight path through the magnetosphere in terms of geomagnetic shielding effects, both for surface incident heavy ions and for particles emerging behind different material thickness. Limited shielding and dose evaluations are performed for simple infinite slab and spherical geometries. Results, given in graphical and tabular form, are analyzed, explained, and discussed. Conclusions are presented and commented on.

50696 **(N—8424519) Energetic electrons in impulsive solar flares.** Batchelor, D.A. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). May 1984. 175p. (NASA-TM—86102). NTIS, PC A08/MF A01.

A new analysis was made of a thermal flare model proposed by Brown, Melrose, and Spicer (1979) and Smith and Lilliequist (1979). They assumed the source of impulsive hard X-rays to be a plasma at a temperature of order 10 to the 8th power K, initially located at the apex of a coronal arch, and confined by ion-acoustic turbulence in a collisionless conduction front. Such a source would expand at approximately the ion-sound speed, C sub S square root of (k T sub e/m sub i), until it filled the arch. Brown, Melrose, and Spicer and Smith and Brown (1980) argued that the source assumed in this model would not explain the simultaneous impulsive microwave emission. In contrast, the new results presented herein suggest that this model leads to the development of a quasi-Maxwellian distribution of electrons that explains both the hard X-ray and microwave emissions. This implies that the source sizes can be determined from observations of the optically-thick portions of microwave spectra and the temperatures obtained from associated hard X-ray observations. In this model, the burst emission would rise to a maximum in a time, t sub r, approximately equal to L/c sub s, where L is the half-length of the arch. New observations of these impulsive flare emissions were analyzed herein to test this prediction of the model. Observations made with the Solar Maximum Mission spacecraft and the Bern Radio Observatory are in good agreement with the model.

50697 **(N—8424520) A comparative look at sunspot cycles.** Wilson, R.M. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center). May 1984. 177p. (NASA-TP—2325). NTIS, PC A09/MF A01.

On the basis of cycles 8 through 20, spanning about 143 years, observations of sunspot number, smoothed sunspot number, and their temporal properties were used to compute means, standard deviations, ranges, and frequency of occurrence histograms for a number of sunspot cycle parameters. The resultant schematic sunspot cycle was contrasted with the mean sunspot cycle, obtained by averaging smoothed sunspot number as a function of time, tying all cycles (8 through 20) to their minimum occurence date. A relatively good approximation of the time variation of smoothed sunspot number for a given cycle is possible if sunspot cycles are regarded in terms of being either HIGH- or LOW-R(MAX) cycles or LONG- or SHORT-PERIOD cycles, especially the latter. Linear regression analyses were performed comparing late cycle parameters with early cycle parameters and solar cycle number. The early occurring cycle parameters can be used to estimate later occurring cycle parameters with relatively good success, based on cycle 21 as an example. The sunspot cycle record clearly shows that the trend for both R(MIN) and R(MAX) was toward decreasing value between cycles 8 through 14 and toward increasing value between cycles 14 through 20. Linear regression equations were also obtained for several measures of solar activity.

50698 **(N—8427656) Emission model of gamma-ray bursts.** Liang, E.P. (Stanford Univ., CA (USA)). Mar 1983. 15p. (NASA-CR—173629). NTIS, PC A02/MF A01.

The emission mechanisms of cosmic gamma-ray bursts are reviewed. In particular, the thermal synchrotron model is discussed as the most viable mechanism for the majority of the continuum emission. Within this framework various information about the source region can be extracted. The picture that emerges is that of a hot (kT .2 - 1.0 sq mc), thin sheet of dense pair-dominated plasma emitting via cyclo-synchrotron radiation in a strong magnetic field (B approximately one-hundred billion to one trillion gauss). Speculations on the origin and structure of this sheet are attempted. The problem of high-energy photons above pair production threshold escaping from the source is also considered.

50699 **(N—8427657) A search for X-ray polarization in cosmic X-ray sources.** Hughes, J.P.; Long, K.S.; Novick, R. (Columbia Univ., New York (USA)). Feb 1983. 14p. (NASA-CR—173635). NTIS, PC A02/MF A01.

Fifteen strong X-ray sources were observed by the X-ray polarimeters on board the OSO-8 satellite from 1975 to 1978. The final results of this search for X-ray polarization in cosmic sources are presented in the form of upper limits for the ten sources which are discussed elsewhere. These limits in all cases are consistent with a thermal origin for the X-ray emission.

50700 **(N—8427658) Elemental advances of ultraheavy cosmic rays.** (Washington Univ., St. Louis, MO (USA); Minnesota Univ., Minneapolis (USA); California Inst. of Tech., Pasadena (USA)). Jun 1984. 28p. (NASA-CR—173650). NTIS, PC A03/MF A01.

The elemental composition of the cosmic-ray source is different from that which has been generally taken as the composition of the solar system. No general enrichment of products of either r-process or s-process nucleosynthesis accounts for the differences over the entire range of ultraheavy (Z 30) elements specific determination of nucleosynthetic contributions to the differences depends upon an understanding of the nature of any acceleration fractionation. Comparison between the cosmic-ray source abundances and the abundances of C1 and C2 chondritic meteorites suggests that differences between the cosmic-ray source and the standard (C1) solar system may not be due to acceleration fractionation of the cosmic rays, but rather to a fractionation of the C1 abundances with respect to the interstellar abundances.

50701 **(N—8427659) A radiometric Bode's Law: Predictions for Uranus.** Desch, M.D.; Kaiser, M.L. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Mar 1984. 17p. (NASA-TM—86074). NTIS, PC A02/MF A01.

The magnetospheres of three planets, Earth, Jupiter, and Saturn, are known to be sources of intense, nonthermal radio bursts. The emissions from these sources undergo pronounced long term intensity fluctuations that are caused by the solar wind interaction with the magnetosphere of each planet. Determinations by spacecraft of the low frequency radio spectra and radiation beam geometry now permit a reliable assessment of the overall efficiency of the solar wind in stimulating these emissions. Earlier estimates of how magnetospheric radio output scales with the solar wind energy input must be revised greatly, with the result that, while the efficiency is much lower than previously thought, it is remarkably uniform from planet to planet. The formulation of a radiometric Bode's Law from which a planet's magnetic moment is estimated from its radio emission output is presented. Applying the radiometric scaling law to Uranus, the low-frequency radio power is likely to be measured by the Voyager 2 spacecraft as it approaches this planet.

50702 **(N—8428721) Microwave and theoretical studies for Cosmic Background Explorer satellite.** Wilkinson, D.T. (Princeton Univ., NJ (USA)). Jul 1983. 7p. (NASA-CR—175248). NTIS, PC A02/MF A01.

The Cosmic Background Explorer (COBE) satellite, its instruments, and its scientific mission are discussed. The COBE radiometer is considered, and measurement of galactic radio emission with masers is reviewed. Extragalactic radiation and zodiacal dust are mentioned briefly.

50703 **(UCRL—91443) Dynamic stellar neutron-capture nucleosynthesis: the need for more nuclear data for the s-process.** Mathews, G.J.; Howard, W.M.; Takahashi, K.; Ward, R.A. (Lawrence Livermore National Lab., CA (USA)). Sep 1984. Contract W-7405-ENG-48. 10p. (CONF-840906—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE85001744.

From Capture gamma-ray spectroscopy conference; Knoxville, TN, USA (10 Sep 1984).

We summarize results from a detailed parameter study of the s-process in models which produce an exponential distribution of exposures by sequential irradiations and dredge up in the stellar environment. The calculations are based on a complete network of measured and calculated neutron capture and beta-decay rates as well as estimates for their temperature dependence. In the framework of these models we identify and systematically vary the astrophysical variables which affect the observed solar-system σN (cross section times abundance) curve. Constraints are placed on the s-

process neutron exposure and flux as well as the temperatures, densities, neutron pulse shape and inter-pulse period. The results also highlight important needs for better nuclear data in various mass regions. 26 references.

50704 **(UWThPh—84-07) Quantum field theory in gravitational background.** Haag, R.; Stein, U.; Narnhofer, H. (Vienna Univ. (Austria)). 1984. 5p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703111.

This is a short survey of results obtained in a DESY preprint (1984) by the authors. We study the influence of gravitation on quantum field theory insofar, that gravity is considered as background field, changing Minkowski space into a general Riemannian manifold. Interest in the model increased when thermal radiation was predicted as consequence of a reasonable state in a Schwarzschild metric (the choice of this state was based on arguments on the time evolution of the black hole). We will restrict the allowed physical states by local conditions and deduce their consequences in the tangent space. They determine already the temperature of the black hole.

50705 **(UWThPh—84-17) Static spin-3/2 perturbations of two-black hole system.** Embacher, F.; Aichelburg, P.C. (Vienna Univ. (Austria)). 1984. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703102.

We construct the most general static regular, non-gauge spin-3/2 perturbations on the Majumdar-Papapetrou background for two black holes. The construction applies a limiting procedure by combining Killing spinors and spacetime perturbations. The supercharge associated with the spin-3/2 field is proportional to the difference of the mass parameters, implying that a system of two equal black holes has zero supercharge.

50706 **Feasibility of a $^{81}Br(\nu,e^-)$ ^{81}Kr solar neutrino experiment.** Hurst, G.S.; Chen, C.H.; Kramer, S.D.; Cleveland, B.T.; Davis, R. Jr.; Rowley, R.K.; Gabbard, F.; Schima, F.J. (Chemical Physics Section, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Physical Review Letters;* **53**: No. 11, 1116-1119(10 Sep 1984). Contract AC05-84OR21400.

A solar neutrino experiment utilizing the interaction of $^{81}Br(\nu,e^-)$ ^{81}Kr to study the ^{7}Be neutrino source in the interior of the sun is shown to be feasible. Resonance ionization spectroscopy was used to count less than 1000 atoms of 2 x 10^5-yr ^{81}Kr, making the bromine experiment possible. Except for the method of counting product atoms, the bromine experiment would be very similar to the successful chlorine detector $^{37}Cl(\nu,e^-)$ ^{37}Ar, and thus it is a natural sequel to the only solar neutrino experiment to date.

50707 **Nucleation rate for black holes.** Kapusta, J.I. (School of Physics and Astronomy, University of Minnesota, Minneapolis, Minnesota 55455). *Physical Review* [*Section*] *D: Particles and Fields;* **30**: No. 4, 831-832(15 Aug 1984). Contract AC02-79ER10364.

A simple heuristic calculation is given for the rate of nucleation of black holes at positive temperature. This calculation is based on the classical theory of nucleation and reproduces the result of Gross, Perry, and Yaffe.

50708 **Models which allow a "new inflationary" universe history.** Gupta, S.; Quinn, H.R. (Institute for Advanced Study, Princeton, New Jersey 08540). *Physical Review* [*Section*] *D: Particles and Fields;* **29**: No. 12, 2791-2797(15 Jun 1984). Contract AC03-76SF00515;AC02-76ER02220.

We analyze a class of grand-unified theories and show that, if one accepts severe fine tuning of many parameters, it is possible to satisfy all the physical constraints that one would like to impose for an inflationary universe scenario. We include some post-inflation constraints, such as the usual zero-temperature hierarchy, as well as the constraints that arise directly from the inflationary period. The new feature of our analysis is that we study a slow-rollover transition between two broken-symmetry minima, rather that the usual Coleman-Weinberg case of a symmetric to broken-symmetry transition.

50709 **The contribution of cosmogenic radioisotopes to solar neutrino flux measurements.** O'Brien, K.; de la Zerda, A. (U.S. Department of Energy, Washington, DC 20545). *Transactions of the American Nuclear Society;* **46**: 641-643(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

50710 **Quark-hadron and chiral transitions and their relation to the early universe.** Schramm, D.N.; Olive, K.A. (Chicago Univ., IL (USA); Fermi National Accelerator Lab., Batavia, IL (USA)). *Nuclear Physics* [*Section*] *A;* **418**: 289c-300c(23 Apr 1984). (CONF-8309168—).

From 3. international conference on ultra-relativistic nucleus-nucleus collisions; Upton, NY, USA (26 Sep 1983).

A review is made of the relation of the quark-hadron and chiral symmetry transitions and the big bang universe. Possible signatures at de-confinement are mentioned and related to cosmology. It is noted that to produce surviving perturbations at this epoch requires black hole production which in turn would require a first-order phase transition. The effect of a quark matter phase in neutron stars is also discussed and related to monopole flux limits through its role in cooling. 30 refs.

50711 **The universe strikes back.** Steigman, G. (Bartol Research Foundation, Univ. of Delaware, Newark, Delaware 19711). pp 259-284 of Unification of the fundamental particle interactions II. Vol. 15. Ellis, J.; Ferrara, S. New York, NY, USA; Plenum Publishing Corp. (1983). (CONF-8110291—).

From Europhysics study conference; Erice, Italy (6 Oct 1981).

The approach to particle physics via cosmology may meet with an obstacle in a series of cosmological puzzles studied in this paper: the flatness-longevity puzzle, the horizon-homogenity puzzle, and the cosmological constant puzzle. An analysis of the geometry and dynamics of the universe leads to an understanding (but not solution) of the flatness-longevity puzzle: possible universes are distinguished by the value of the dimensionless quantity N, the coordinate density of ER particles, such that the longevity of the universe is fixed by N. Universes where nonrelativistic particles dominate are then studied. An inflationary scenario proposed as a solution to these puzzles is studied, but found to have some difficulties.

50712 **Neutron star cooling: effects of envelope physics.** Van Riper, K.A. (Los Alamos National Lab., NM (USA)). pp 513-516 of Supernova remnants and their X-ray emission. Proceedings of the IAU symposium No. 101 held in Venice, Italy 30 August - 2 September 1982. Danziger, J. (European Southern Observatory, Garching (Germany, F.R.)); Gorenstein, P. (Harvard Univ., Cambridge, MA (USA). Center for Astrophysics) (eds.). Dordrecht, Netherlands; D. Reidel (1983). (CONF-820884—).

From International Astronomical Union symposium on supernova remnants and their X-ray emission; Venice, Italy (29 Aug 1982).

Includes subject and object indexes.

Neutron star cooling calculations are reported which employ improved physics in the calculation of the temperature drop through the atmosphere. The predicted neutron star surface temperatures, in the interesting interval $300 <= t\ (yr) <= 10^5$, do not differ appreciably from the earlier results for a non-magnetic star; for a magnetic star, the surface temperature is lower than in the previous work. Comparison with observational limits show that an exotic cooling mechanism such as neutrino emission from a pion-condensate or in the presence of percolating quarks, is not required, unless the existence of a neutron star in the Tycho or SN1006 supernova remnants is established.

50713 **N49: the site of a gamma-ray burst. Preliminary results from X-ray observations.** Pizzichini, G. (Istituto TESRE/CNR, Bologna, Italy); Cline, T.L.; Desai, U.D.; Teegarden, B.J. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center); Evans, W.D.; Fenimore, E.E.; Klebesadel, R.W.; Laros, J.G. (Los Alamos Scientific Lab., NM (USA)); Hurley, K.; Niel, M. pp 573-577 of Supernova remnants and their X-ray emission. Proceedings of the IAU symposium No. 101 held in Venice, Italy 30 August - 2 September 1982. Danziger, J. (European Southern Observatory, Garching (Germany, F.R.)); Gorenstein, P. (Harvard Univ., Cambridge, MA (USA). Center for Astrophysics) (eds.). Dordrecht, Netherlands; D. Reidel (1983). (CONF-820884—).

From International Astronomical Union symposium on supernova remnants and their X-ray emission; Venice, Italy (29 Aug 1982).

Includes subject and object indexes.

The error box of the unusual gamma-ray burst of March 5, 1979 falls completely inside the optical and radio image of the Supernova Remnant N49 in the Large Magellanic Cloud. This region was observed twice in X-rays with the High Resolution Imager of the Einstein Observatory, six weeks and nearly two years after the gamma-ray burst. The comparison between the two observations is shown.

6402 Atmospheric Physics

REFER ALSO TO CITATION(S) 64020050654

50714 **(DOE/EV/04321—4) Infrared excitation of clusters and ions of atmospheric interest. First progress report, September 1, 1983-August 31, 1984.** Muenter, J.S. (Rochester Univ., NY (USA). Dept. of Chemistry). 31 Aug 1984. Contract AC02-77EV04321. 6p. (COO—4321A-4). NTIS, PC A02/MF A01; GPO Dep. File Number DE85002098.

The first year of this project has been occupied to a significant extent in finishing up work initiated in the previous granting period. Several publications have appeared during the past year and copies are included here. Major new efforts have involved using an infrared color center laser to excite molecular beams of both stable molecules and molecular complexes. Excited state electronic structure and dissociation dynamics have been obtained from this work.

50715 **(N—84-24663) Trapped-proton energy spectrum determination (M0002-1).** Rich, F.J.; Michael, I.; Fishman, G.J.; Segalyn, P.L.; Mcnulty, P.J.; Rao, Y.V. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center). Feb 1984. 4p. NTIS, PC A09/MF A01.

The objective of this experiment is to measure the flux and energy spectrum of protons with energies of 1 to MeV. These protons are trapped on the Earth's magnetic field lines as part of the inner radiation belt, or Van Allen zone. The proton will be encountered predominantly in the South Atlantic anomaly at a 90 deg pitch angle.

50716 **(N—84-26512) Characteristics of the magnetospheric source of interplanetary energetic particles.** Luhmann, J.G.; Walker, R.J.; Russell, C.T. (Johns Hopkins Univ., Laurel, MD (USA). Applied Physics Lab.; California Univ., Los Angeles (USA)). May 1984. 18p. NTIS, PC A08/MF A01.

The Earth's bow shock is frequently cited as an example of an astrophysical shock where particle acceleration is observed. However, because energetic particles observed upstream of the bow shock may be accelerated within the magnetosphere, it is important to understand the properties of the magnetospheric source. A first order picture of the spatial distribution of magnetospheric particles in the magnetosheath and upstream is obtained by mapping those magnetic field lines which drape over the magnetopause through the bow shock. Subsets of these field lines that connect to potential sites of magnetic merging on the magnetopause are also traced in the event that leakage occurs preferentially where normal components of the field are present across the boundary. The results can be used to determine whether the so-called diffuse particles observed upstream are accelerated locally or within the magnetosphere.

50717 **Multistation study of nighttime scintillations in low latitudes: evidence of control by equatorial F region irregularities.** Somayajulu, Y.V.; Garg, S.C.; Dabas, R.S.; Singh, L. (National Physical Lab. of India, New Delhi). *Radio Science;* **19**: 707-718(May 1984). (CONF-830274—).

From International Union of Radio Science and COSPAR symposium on bveacon satellite studies of the earth's environment; New Delhi, India (3 Feb 1983).

Equatorial spread F (ESF) and VHF scintillations have only in recent years been related to large-scale upwelling plumelike irregularity structures identified on VHF backscatter radar intensity maps. The present investigation is concerned with the results of an experiment of VHF scintillations recorded at a meridian chain of stations in India extending from close to the magnetic equator to 24.8 deg N magnetic latitude. It is found that the latitudinal develoopment of scintillation-producing irregularities during high solar activity conditions is controlled by the development of ESF irregularities over the magnetic equator. Scintillations at all the stations equatorward of 21 deg N magnetic latitude are saturated, and their onset in the postsunset hours is almost abrupt. The occurrence of scintillations at latitudes away from the equator is dependent on their prior occurrence near the magnetic equator. 57 references.

6403 Atomic, Molecular, And Chemical Physics

REFER ALSO TO CITATION(S) 64030050102, 50189, 50210, 50321, 50459

50718 **(CONF-830942—91-Draft) Enhanced sputtering of graphite at high temperature.** Roth, J.; Roberto, J.B.; Wilson, K.L. (Oak Ridge National Lab., TN (USA); Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.); Sandia National Labs., Livermore, CA (USA)). Dec 1983. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001112.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

The enhanced sputtering of graphite at temperatures above 1000°K has been investigated for a variety of incident ion species and energies. Papyex graphite strips were irradiated with 35 to 150 keV H, C, O, and Ar ions in the temperature range from 300 to 1800°K, and with 0.13 keV H ions at 1800°K. Sputtering yields were determined by weight change measurements, and were compared in many cases with yields determined by in-situ ion beam analysis of collector probes. For temperatures above 1000°K, enhanced sputtering yields are found which increase with temperature to 6 to 20 times room temperature values at 1800°K. At a given temperature, measured yields for all species and energy combinations scale with the nuclear deposited energy at the surface and do not correlate with electronic losses. The low energy H measurements indicate a transferred energy threshold of $\sim$ 5 eV for the enhanced erosion process, significantly lower than the displacement threshold energy in graphite of 30 eV. The enhanced erosion is characterized by an activation energy which varies from 0.5 to 1.1 eV with decreasing incident particle mass. The overall results, together with recently reported velocity and mass spectra of the sputtered particles, suggest a radiation-enhanced sublimation mechanism.

50719 **(CONF-840387—11) Multiphoton ionization of cesium atoms above and below the two-photon ionization threshold.** Dodhy, A.; Stockdale, J.A.D.; Compton, R.N. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000976.

From 2. topical meeting on laser techniques in the extreme ultraviolet; Boulder, CO, USA (5 Mar 1984).

Two- and three-photon ionization processes in cesium atoms using a single pulsed-dye laser and a cesium atomic beam have been investigated. Photoelectron angular distributions have been measured for two-photon resonant, three-photon ionization via the nd states (n = 12, 15, and 21), for two-photon nonresonant transitions

over the photoelectron energy range from ~ 26 to 100 MeV, and for quasi-free-free transitions. 13 references, 6 figures.

50720 **(CONF-840387—12) Vacuum ultraviolet photoionization of cold molecular beams.** Miller, J.C.; Compton, R.N. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001092.

From 2. topical meeting on laser techniques in the extreme ultraviolet; Boulder, CO, USA (5 Mar 1984).

Experiments will be described which combine nonlinear optics, mass- and energy-resolved ion detection, energy-resolved electron detection, and a supersonic nozzle to study vacuum ultraviolet photoionization and photoelectron spectroscopy of ultracold molecules.

50721 **(CONF-840387—13) Multiphoton ionization of atomic cesium.** Compton, R.N.; Klots, C.E.; Stockdale, J.A.D.; Cooper, C.D. (Oak Ridge National Lab., TN (USA); Georgia Univ., Athens (USA). Dept. of Physics). 1984. Contract AC05-84OR21400. 14p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001266.

From 2. topical meeting on laser techniques in the extreme ultraviolet; Boulder, CO, USA (5 Mar 1984).

We describe experimental studies of resonantly enhanced multiphoton ionization (MPI) of cesium atoms in the presence and absence of an external electric field. In the zero-field studies, photoelectron angular distributions for one- and two-photon resonantly enhanced MPI are compared with the theory of Tang and Lambropoulos. Deviations of experiment from theory are attributed to hyperfine coupling effects in the resonant intermediate state. The agreement between theory and experiment is excellent. In the absence of an external electric field, signal due to two-photon resonant three-photon ionization of cesium via np states is undetectable. Application of an electric field mixes nearby nd and ns levels, thereby inducing excitation and subsequent ionization. Signal due to two-photon excitation of ns levels in field-free experiments is weak due to their small photoionization cross section. An electric field mixes nearby np levels which again allows detectable photoionization signal. For both ns and np states the field induced MPI signal increases as the square of the electric field for a given principal quantum number and increases rapidly with n for a given field strength. Finally, we note that the classical two-photon field-ionization threshold is lower for the case in which the laser polarization and the electric field are parallel than it is when they are perpendicular. 22 references, 11 figures.

50722 **(CONF-840786—3) Electron spectrometry experiments with the use of synchrotron radiation.** Krause, M.O. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 18p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001286.

From 9. international conference on atomic physics; Seattle, WA, USA (23 Jul 1984).

A survey of selected experiments is given to illustrate the recent advances that have been made in the study of the electronic structure and dynamics of free atoms.

50723 **(CONF-840829—3) Forward electron production in heavy ion-atom and ion-solid collisions.** Sellin, I.A. (Tennessee Univ., Knoxville (USA); Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 14p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001256.

From International conference on x-ray and inner-shell processes in atoms, molecules and solids; Leipzig, Germany D.R. (20 Aug 1984).

A sharp cusp in the velocity spectrum of electrons, ejected in ion-atom and ion-solid collisions, is observed when the ejected electron velocity vector v/sub e/ matches that of the emergent ion vector v/sub p/ in both speed and direction. In ion-atom collisions, the electrons originate from capture to low-lying, projectile-centered continuum states (ECC) for fast bare or nearly bare projectiles, and from loss to those low-lying continuum states (ELC) when loosely bound projectile electrons are available. Most investigators now agree that ECC cusps are strongly skewed toward lower velocities, and exhibit full widths half maxima roughly proportional to v/sub p/ (neglecting target-shell effects, which are sometimes strong). A close examination of recent ELC data shows that ELC cusps are instead nearly symmetric, with widths nearly independent on v/sub p/ in the velocity range 6 to 18 a.u., a result only recently predicted by theory. Convoy electron cusps produced in heavy ion-solid collisions at MeV/u energies exhibit approximately velocity-independent widths very similar to ELC cusp widths. While the shape of the convoy peaks is approximately independent of projectile Z, velocity, and of target material, it is found that the yields in polycrystalline targets exhibit a strong dependence on projectile Z and velocity. While attempts have been made to link convoy electron production to binary ECC or ELC processes, sometimes at the last layer, or alternatively to a solid-state wake-riding model, our measured dependences of cusp shape and yield on projectile charge state and energy are inconsistent with the predictions of available theories. 10 references, 8 figures, 1 table.

50724 **(CONF-8404190—3) Comments on the image contrast from inelastically scattered electrons.** Pennycook, S.J. (Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000899.

From Warner-Brandt workshop on penetration phenomena: in elastic near-surface interaction; Oak Ridge, TN, USA (12 Apr 1984).

There is considerable interest in forming images from inelastically scattered electrons, both for studying the scattering process itself, and to obtain information on surface structure and composition. Inelastic surface excitations are prominent features of the energy loss spectrum for reflection off bulk surfaces at grazing angles, or in aloof geometry from surfaces of small particles. Details of obtaining and using such images are discussed.

50725 **(CONF-8406206—1) Anomalous mean free paths for scattering of convoy electrons generated by fast, highly ionized ions in thin solid targets.** Sellin, I.A.; Berry, S.D.; Breinig, M.; Bottcher, C.; Latz, R.; Burghardt, M.; Folger, H.; Frischkorn, H.J.; Groeneveld, K.O.; Hofmann, D. (Tennessee Univ., Knoxville (USA). Dept. of Physics; Oak Ridge National Lab., TN (USA); Frankfurt Univ. (Germany, F.R.). Inst. fuer Kernphysik). 1984. Contract AC05-84OR21400. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001279.

From Symposium on the physics of electron ejection in ion-atom and ion-solid collisions; Aarhus, Denmark (29 Jun 1984).

We have measured the yields of convoy electrons associated with 15.2-MeV/amu Ni^{24+} and Ni^{26+} ions transversing thin, polycrystalline foils of C and Al. The thicknesses used were in the range 3 to 500 $\mu g/cm^2$. By observing how the yield saturates with increasing thickness, we obtained effective mean free paths (MFPs) for the scattering of convoy electrons out of the collector half angle (1.54°).

50726 **(CONF-8409129—2) Effects of dc electric fields on multiphoton ionization spectra in cesium.** Klots, C.E.; Compton, R.N. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001542.

From 3. international conference on multiphoton processes; Iraklion, Crete, Greece (4 Sep 1984).

The three-photon (one frequency) ionization of cesium atoms is greatly enhanced when the second photon is resonant with a Rydberg nd level. Enhancement by the ns levels is comparatively small. Three-photon ionization is also observed when the first photon excites a quadrupole transition to 5d. This occurs when either (a) the first photon is resonant with one of the 5d spin-orbit states, or (b) when the second photon is resonant with the 7f state. A dc electric field introduces a number of new features: (a) high Rydberg states can be field-ionized, (b) the photoionization cross sections of the ns levels are greatly enhanced, (c) two-photon access to the np and nf series is induced, and (d) two-photon access to 7g (via a virtual quadrupole transition to 5d) is observed. These effects have been quantified, the role of laser polarization documented, and a useful scaling law (as a function of the effective principle quantum number) has been demonstrated. 8 references, 6 figures.

50727 **(DOE/ER/01674—T1) Basic studies of atomic dynamics. Progress report, September 1, 1983-July 31, 1984.** Fano, U. (Chicago Univ., IL (USA)). 31 Jul 1984. Contract AC02-76ER01674. 14p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84015661.

The novel approach to the Zeeman effect of Rydberg electrons introduced in the proposal for 1984 has yielded important qualitative results and conclusions, leading to the design of a broader and more detailed procedure described in the accompanying proposal. A new technique for studying electron correlations in open valence shells has proved very successful in applications to Be and Mg, yielding unexpected insights; it is now being extended to Al. The study of correlations originating at high electron density has led to an initial publication and is approaching completion.

50728 **(DOE/ER/10578—T4) Topics in high resolution spectroscopy of stored ions.** Schuessler, H.A. (Texas A and M Univ., College Station (USA). Dept. of Physics). 1984. Contract AS05-80ER10578. 30p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85002093.

Recent developments in stored ion spectroscopy are discussed with emphasis on the following aspects: (1) Very high resolution experiments; (2) Precision spectroscopy of one-electron ions; (3) Measurement of the magnetic moment of the bound electron; and (4) Feasibility of external ion injection to extend ion storage techniques to highly charged and possibly radioactive ions. The question of what can be learned from these experiments about nuclear structure and quantum electrodynamical contributions to the hyperfine interaction and the atomic Zeeman effect is addressed. 64 references, 5 figures, 2 tables.

50729 **(DOE/ER/10618—12) Extension of the multiconfiguration Hartree-Fock program for continuum functions.** Fischer, C.F.; Saha, H.P. (Vanderbilt Univ., Nashville, TN (USA). Dept. of Computer Science). 1984. Contract AS05-80ER10618. 20p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002080.

The wave function of an outer electron coupled to a core, possibly with correlation included in the core, is similar to a multiconfiguration Hartree-Fock (MCHF) wavefunction, except that the radial function of the electron is a continuum function, and different numerical procedures are required for determining it. Only a single continuum function is allowed, and the orbitals defining the wave function of the core and bound channels are assumed to be fixed. The coefficients in the expansion of the wave function of the core are also fixed and are the result of a bound state calculation for the core. Under these assumptions, the equation for the radial wave function of the electron is solved iteratively. The asymptotic phase shift is evaluated. In order to test the accuracy of the procedure, calculations were performed for the scattering of electrons by neutral hydrogen. Some results of a photo-ionization calculation are compared, and for an electron transition in nitrogen. (LEW)

50730 (INIS-mf—9064, pp 57) **Polarization transfer to inner-vacancies of ions swiftly traversing polarized ion hosts.** Stuchbery, A.E. (Australian National Univ., Canberra. Research School of Physical Sciences). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50731 (INIS-mf—9064, pp 16) **Pions and muons - beyond exotic atoms.** Vogt, E.W. 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50732 (INIS-mf—9065, pp 3-7) **Ion induced x-ray emission.** Cohen, D.D. (Australian Inst. of Nuclear Science and Engineering, Lucas Heights). Nov 1983. NTIS (US Sales Only), PC A10/MF A01. File Number TI84780622. (CONF-8311183—).

From 3. Australian conference on nuclear techniques of analysis; Lucas Heights, Australia (1 Nov 1983).

Three types of perturbation theory have been used to describe inner shell vacancy production by light to medium ion bombardment. Inclusion of Coulomb deflection and binding effects in the plane wave Born approximation is discussed. More recently this relativistic Coulomb deflection corrected perturbed stationary state theory has been extended to include energy loss effects. This ECPSSR theory is one of the most successful in predicting inner shell ionisation cross sections for both K and L shells, provided the projectile to target atomic number ratio is less than about 0.3 and, for the heavier ions, electron capture processes by the projectile are included.

50733 (INIS-mf—9065, pp 25-26) **New look at the L subshell Coulomb deflection factors for inner shell ionisation.** Cohen, D.D. (Australian Inst. of Nuclear Science and Engineering, Lucas Heights). Nov 1983. NTIS (US Sales Only), PC A10/MF A01. File Number TI84780622. (CONF-8311183—).

From 3. Australian conference on nuclear techniques of analysis; Lucas Heights, Australia (1 Nov 1983).

Individual L subshell ionisation cross sections for proton and He^+ ion bombardment of heavy targets, Dy to U, have been measured for the ion energy range 1 to 3 MeV. It has been shown that ECPSSR predictions are good for ion energies above about .7 MeV/a.m.u., but below this significant ion velocity dependent discrepancies occur, especially for the L_2 subshell. A semi-empirical solution to this problem is outlined. It is suggested that the Coulomb deflection factor for the L shell be replaced. With the new approach experimentally observed results for ion energies down to 150 keV/a.m.u. can be predicted.

50734 (INIS-mf—9065, pp 32-34) **L subshell X-ray production by 100 to 250 keV/a.m.u. ions.** Harrigan, M.F.; Spicer, B.M. (Melbourne Univ., Parkville (Australia). School of Physics); Cohen, D.D. (Australian Inst. of Nuclear Science and Engineering, Lucas Heights). Nov 1983. NTIS (US Sales Only), PC A10/MF A01. File Number TI84780622. (CONF-8311183—).

From 3. Australian conference on nuclear techniques of analysis; Lucas Heights, Australia (1 Nov 1983).

Individual L subshell ionization cross sections have been measured for 100 to 200 keV protons on gadolinium and 600 to 1000 keV He^+ ions on tungsten. Experimental results for the individual L subshells are compared with the theoretical ionization cross sections of the ECPSSR theory as developed by Brandt and Lapicki. The differences are discussed as a function of the reduced ion velocity.

50735 (INIS-SU—216, pp 194-212) **Parity nonconservation effects in stereoisomers.** Gorshkov, V.G.; Kozlov, M.G.; Labzovskij, L.N. 1982. (In Russian). NTIS (US Sales Only), PC A10/MF A01. File Number TI84780550.

In Elementary particle physics. Proceedings of 17. Winter school of Leningrad Institute of Nuclear Physics.

Differences in superfine structures of right and left stereoisomer forms conditioned by parity nonconservation are considered. The Zeeman splitting in a magnetic field turned out to be also different. In stereoisomers containing odd number of electrons these effects proved to be considerably higher (in stereoisomer-radicals).

50736 (INIS-SU—247, pp 235-238) **Description of recoil nuclei energy spectra for element analysis of materials.** Adeev, G.D.; Vershinin, G.A.; Shadrin, V.N.; Chernov, I.P. 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. File Number TI84780555. (CONF-8205270—).

From 12. All-Union conference on physics of interaction between charged particles and crystals; Moscow, USSR (25 May 1982).

Spectra of recoil nuclei for the geometry of "reflection" experiment based on approximation of straight-line motion of a colliding ion and a knocked-out recoil nucleus in the target, are described. Energy losses of particles are determined inambiguously by lengths of paths of the in and recoil nucleus in the target. In this case, losses of the ion and recoil nucleus at the atoms of light elements analyzed are neglected. Energy spectra of hydrogen recoil nuclei calculated in the approximation of single scattering are ana-

lyzed. Al is considered as a matrix, 16 MeV nitrogen ions are used as colliding ions.

50737 (INIS-SU—247, pp 227-230) **Internal monitor in Rutherford scattering.** Zavodchikov, V.M.; Yatis, A.A. 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. File Number TI84780555. (CONF-8205270—).

From 12. All-Union conference on physics of interaction between charged particles and crystals; Moscow, USSR (25 May 1982).

The method of beam monitoring is described which consists in comparing the integrated part of spectrum in low energy range at fixed registration energy values for samples with similar substrate but with coatings in the form of a set of consequent thin films or a film of complex composition of different thickness. The estimate of reproducibility of internal monitor is performed by calculational and experimental ways for GaAs substrates. Calculations and multiple experiments performed prove the possibility of using "internal monitor" in elastic scattering of charged particles for analysis of amorphous targets and disoriented semiconducting structures with complex coatings with variable atomic composition in the near-surface region.

50738 (INIS-SU—247, pp 223-226) **New method for determination of interstitial profiles and sputtering coefficients.** Rozhkov, V.V.; Khazan, S.M.; Polyakova, G.N.; Opalev, O.A. 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. File Number TI84780555. (CONF-8205270—).

From 12. All-Union conference on physics of interaction between charged particles and crystals; Moscow, USSR (25 May 1982).

The method of determining introduction profiles or spraying coefficients is suggested in which introduction profile determination requires irradiation with only one ion beam, while spraying coefficients can be determined with the express method during irradiation. The layout of the device is given which is used for experimental test of the new method of spraying coefficient measurement. The results obtained give a good agreement with previously published data.

50739 (INIS-SU—247, pp 217-218) **Punch-through of atomic planes at a shallow incidence angle of proton beam.** Kovaleva, E.A.; Shipatov, Eh.T. 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. File Number TI84780555. (CONF-8205270—).

From 12. All-Union conference on physics of interaction between charged particles and crystals; Moscow, USSR (25 May 1982).

The punch-through phenomenon of atomic planes (001) in KF monocrystals with 10 MeV protons depending on the incidence angle of particles (+), is considered. It is shown that atomic planes are transparent for the incident flux even at shallow beam incidence angles; the effectiveness of punch-through for planes increases with psi increase.

50740 (INIS-SU—247, pp 213-216) **Use of target rotation method for separation of backscattered ion yields on different types of atoms of multicomponent target.** Grazhdankin, V.N.; Shipatov, Eh.T. 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. File Number TI84780555. (CONF-8205270—).

From 12. All-Union conference on physics of interaction between charged particles and crystals; Moscow, USSR (25 May 1982).

The method of separating yields of ion backscattering at atoms of different sort of a multicomponent target is described. The method is based on comparing spectra obtained for different angles of target location. The method has been tested when treating backscattering spectra calculated with the help of a computer for given concentraration distributions. It is shown that the error of calculations is determined by the statistics level.

50741 (INIS-SU—247, pp 209-212) **Analysis of multicomponent targets using H^+ and He^+ fast ion backscattering.** Grazhdankin, V.N.; Shipatov, Eh.T. 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. File Number TI84780555. (CONF-8205270—).

From 12. All-Union conference on physics of interaction between charged particles and crystals; Moscow, USSR (25 May 1982).

Spectra unfolding method is described for backscattering of H^+ and He^+ fast ions. The method permits to find the distribution of ratios of concentrations of atoms of a N-component target. When calculating concentrations the shift of moderation cross sections in the depth target is taken into account. The above method is tested when processing spectra calculated using a computer for the given concentration distributions. Ion straggling, equipment expansion and fluctuations of reference number in spectra, are calculated. The test using targets of different composi. tion has shown that the main errors are brought by spectrum distortions connected with equipment expansion.

50742 (INIS-SU—247, pp 202-204) **Unfolding of concentration profiles from backscattering energy spectra with allowance for some distortion factors.** Bagaev, V.N.; Puzanov, A.A.; Urmanov, A.R.; Ufukov, P.P.; Shul'gin, B.V. 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. File Number TI84780555. (CONF-8205270—).

From 12. All-Union conference on physics of interaction between charged particles and crystals; Moscow, USSR (25 May 1982).

The solution of the problem of determination of molar shares of atoms rsub(a)(X)–Nsub(a)/(X)/[Σsub((=))sup(N)nc(X)] (a=1, 2...) in the N component target depending on (X) depth using the measured energy spectra of ion backscattering from multicomponent targets, is given. For solution, it is advisable to take such rsub(a)(X) (a=1, 2...) functions which give the maximum to the following functional Msub(α)[(X), U(E)], where Usub(n)(Esub(i)) is the value of n-spectrum at E=Esub(i). It is noted that Msub(α)(r, U) functional is positively determined and it is possible to use many of the methods known for its minimization.

50743 (LBL—17827) **Effect of resonant microwave power on a PIG ion source.** Brown, I.G.; Galvin, J.E.; Gavin, B.F.; MacGill, R.A. (Lawrence Berkeley Lab., CA (USA)). Aug 1984. Contract AC03-76SF00098. 15p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001396.

We have investigated the effect of applying microwave power at the electron cyclotron frequency on the characteristics of the ion beam extracted from a hot-cathode PIG ion source. No change was seen in the ion charge state distribution. A small but significant reduction in the beam noise level was seen, and it is possible that the technique may find application in situations where beam quiescence is important. 29 references, 2 figures.

50744 (LBL—18011) **Structure of adsorbed monolayers. The surface chemical bond.** Somorjai, G.A.; Bent, B.E. (Lawrence Berkeley Lab., CA (USA)). Jun 1984. Contract AC03-76SF00098. 69p. (CONF-8406199—1). NTIS, PC A04/MF A01; GPO Dep. File Number DE84016879.

From 8. Scandinavian symposium on surface chemistry; Lund, Sweden (4 Jun 1984).

This paper attempts to provide a summary of what has been learned about the structure of adsorbed monolayers and about the surface chemical bond from molecular surface science. While the surface chemical bond is less well understood than bonding of molecules in the gas phase or in the solid state, our knowledge of its properties is rapidly accumulating. The information obtained also has great impact on many surface science based technologies, including heterogeneous catalysis and electronic devices. It is hoped that much of the information obtained from studies at solid-gas interfaces can be correlated with molecular behavior at solid-liquid interfaces. 31 references, 42 figures, 1 table.

50745 (LBL—18080) **Structure determination of molecular adsorbates with dynamical LEED and HREELS.** Van Hove, M.A. (Lawrence Berkeley Lab., CA (USA)). Aug 1984. Contract AC03-76SF00098. 11p. (CONF-840821—4). NTIS, PC A02/MF A01; GPO Dep. File Number DE85002007.

From 1. international conference on the structure of surfaces (ICSOS); Berkeley, CA, USA (13 Aug 1984).

Molecular adsorbate structures can be determined by combined Low-Energy Electron Diffraction (LEED) with High-Resolution Electron Energy Loss Spectroscopy (HREELS). The HREEL vibrational spectroscopy identifies the molecular species, whose bond lengths and angles are obtained by LEED. Appropriate calculational methods are required in LEED to solve complex molecular structures: such methods will be discussed for large molecules, for large unit cells and for disordered adsorbates. Results have been obtained for the following molecular species adsorbed on several low-Miller-index metal surfaces: CO, $C_2H_2 \rightarrow CCH_3$, C_2H_4, $\rightarrow CCH_3CH_3$ and C_6H_6. The presently available methods should be capable of solving a multitude of molecular adsorbate structures, including large molecules, coadsorbates and disordered species.

50746 **(LBL—18216) Calculation and computer simulation of the Paraboloidal Mirror Analyzer (PMA).** Liu, G.; Barton, J.J.; Bahr, C.C.; Shirley, D.A. (Lawrence Berkeley Lab., CA (USA)). Aug 1984. Contract AC03-76SF00098. 57p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85001417.

A semianalytical method is proposed to calculate the electric field and electron motion inside the paraboloidal electron mirror. The error of field calculation is not more than 0.01% and that of electron motion calculation is not more than 0.1%. Calculation and computer simulation show that such an electron mirror can give very good angle resolution even for electrons having a wide energy spectrum.

50747 **(LBL—18275) Time-resolved resonant Raman scattering and hot luminescence at the 1S ortho-exciton in Cu_2O.** Weiner, J.S.; Yu, P.Y. (Lawrence Berkeley Lab., CA (USA)). Jul 1984. Contract AC03-76SF00098. 7p. (CONF-840879—9). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002071.

From 17. international conference on the physics of semiconductors; San Francisco, CA, USA (6 Aug 1984).

The time dependence of one-phonon and two-phonon Raman modes at the 1S yellow ortho-exciton of Cu_2O is reported. In both cases it is found that these modes should be more correctly identified as hot luminescence. The data are fitted using a model which has no adjustable parameters. 13 references, 3 figures.

50748 **(N—84-20843) Comments on laser-excited fluorescence of the hydroxyl radical: relaxation coefficients at atmospheric pressure, appendix 5.** Wang, C.C. (Ford Motor Co., Dearborn, MI (USA)). 1983. 6p. (NASA-CR—175442). NTIS, PC A02/MF A01.

The lifetime of the excited state of a atom or molecule is often determined from the rate of fluorescence decay originating as a function of buffer gas pressure, an accurate determination is made of the rates of collision induced transitions away from the excited state. Deconvolution can in principle be employed to resolve fluorescence times shorter than the response times of the system. However, attainable reproducibility and accuracy in actual experiments usually set a limit beyond which no meaningful results are expected. Prudence thus dictates that the results of deconvolution be viewed with extreme caution whenever fluorescence time much shorter than the response of times of the system are indicated.

50749 **(OEFZS—4058) Observation of single phonon scattering of Ne^{20}-atoms from a LiF (001) surface.** Semerad, E.; Hoerl, E.M. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). Jan 1981. 5p. (ME—201/81). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703104.

The paper reports single phonon scattering experiments of a $k = 24.62\ A^{o-1}$ Ne^{20}-beam on a LiF (001) surface. An interpretation of the observed peaks in terms of surface and/or bulk modes is discussed.

50750 **(UWThPh—84-05) Structure of the periodic system.** Grosse, H.; Pflug, A. (Vienna Univ. (Austria)). 1984. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703103.

A recently derived theorem on the level order for potential models is used to get information on the structure of the periodic system. The usual explanation for the level order is seen to be not precise enough.

50751 **^{57}Fe Moessbauer effect in $ThFe_5$ hydride.** Gubbens, P.C.M.; van der Kraan, A.M.; Buschow, K.H.J. (Interuniversitair Reactorinstituut, 2629 JB Delft, Netherlands). *Journal of Applied Physics;* **56**: No. 9, 2547-2552(1 Nov 1984).

The hydrogen absorption in the $CaCu_5$-type compound $ThFe_5$ was studied by x-ray diffraction, magnetic measurements, and ^{57}Fe Moessbauer spectroscopy. Hydrogen absorption leads to a 6% increase of the unit cell volume without change in crystal structure. There is only a slight change in magnetic properties. The ^{57}Fe Moessbauer spectra of the ternary hydride are characterized by relatively sharp lines, an increase in hyperfine field, and an increase in isomer shift relative to the uncharged compound. The increase in ^{57}Fe isomer shift invariably observed after charging of Fe compounds with hydrogen is explained in terms of the Miedema—van der Woude model. The relatively low tendency of the hydride of $ThFe_5$ to decompose (disproportionate) as compared to some other Th-Fe hydrides is explained on the basis of a kinetic approach.

50752 **Experimental study of muon-catalyzed fusion in low-density deuterium-tritium gas.** Breunlich, W.H.; Cargnelli, M.; Kammel, P.; Marton, J.; Pawlek, P.; Werner, J.; Zmeskal, A.J.; Crowe, K.M.; Kurck, J.; Janett, A. (Osterreichische Akademie der Wissenschaften, A-1090 Vienna, Austria). *Physical Review Letters;* **53**: No. 12, 1137-1140(17 Sep 1984). Contract AT03-81ER40004.

High rates for mesomolecular processes were found in a study of neutron spectra from muon-catalyzed dt fusion in low-density D/T mixtures. An interpretation is given in terms of a reaction-kinetics model which includes hyperfine effects. The hyperfine components of the $d\mu t$ formation rates, first separated in this experiment, are large from 30 to 300 K. An unexpected temperature dependence for the transition rate between μt hyperfine states is found.

50753 **Effects of magnetic and electric fields on highly excited atoms.** Clark, C.W.; Lu, K.T.; Starace, A.F. (SERC Daresbury Lab., Warrington, WA). pp 247-320 of Progress in atomic spectroscopy. Beyer, H.J.; Kleinpoppen, H. New York, NY, USA; Plenum Press (1984).

This chapter describes recent theoretical developments on highly excited atoms in uniform external fields. Topics considered include diamagnetic effects in the hydrogen atom (the equations of motion, solutions near the ionization threshold), the Stark effect in the hydrogen atom (photoionization cross section, excited Rydberg states), nonhydrogenic atoms in external fields (quantum defect theory of Rydberg spectra, channel mixing effects on magnetic shifts, magnetic contribution to channel mixing, coupling of parabolic channels by scattering from the ion core), the competition of magnetic and electric forces (the induced Stark effect, crossed external electric and magnetic fields), and general properties of atoms in magnetic fields of astrophysical strength (atomic shell structure, magnetic field induced binding, Landau level resonances).

50754 **Time-resolved fluorescence spectra of rotationally cooled NO2.** Ferrell, W.R.; Chen, C.H.; Payne, M.G. (Oak Ridge National Lab., TN). *Journal of Physics B: Atomic and Molecular Physics;* **16**: 1721-1732(28 May 1983). Contract W-7405-ENG-26.

A tunable, pulsed dye laser was used to selectively excite rotationally cooled NO2. Excitation fluorescence spectra, as well as wavelength-resolved fluorescence spectra, are presented. The radiative decay modes for various transitions are determined by examining the temporal dependence of the wavelength-resolved fluorescence lines. Single exponential decays were observed. 18 references.

6404 Fluid Physics

REFER ALSO TO CITATION(S) 64041049450

50755 (INIS-SU—216, pp 137-157) **Superfluid ^{3}He. Neutral currents, T invariance, gravitation.** Khriplovich, I.B. 1982. (In Russian). NTIS (US Sales Only), PC A10/MF A01. File Number TI84780550.

In Elementary particle physics. Proceedings of 17. Winter school of Leningrad Institute of Nuclear Physics.

The possibility of the usage of superfluid ^{3}He for experimental investigation of neutral currents of weak interactions, for searching T invariance distortion and measuring "quasimagnetic" component of the Earth gravitational field is discussed. ^{3}He is found to be a wonderful macroscopic quantum gyroscope whose capabilities in precise physical experiments are not fully realized yet.

50756 (LBL—18217) **Three-dimensional vortex methods.** Greengard, C.A. (Lawrence Berkeley Lab., CA (USA)). Aug 1984. Contract AC03-76SF00098. 61p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85000391.

Three-dimensional vortex methods for the computation of incompressible fluid flow are presented from a unified point of view. Reformulations of the filament method and of the method of Beale and Majda show them to be very similar algorithms; in both of them, the vorticity is evaluated by a discretization of the spatial derivative of the flow map. The fact that the filament method, the one which is most often used in practice, can be formulated as a version of the Beale and Majda algorithm in a curved coordinate system is used to give a convergence theorem for the filament method. The method of Anderson is also discussed, in which vorticity is evaluated by the exact differentiation of the approximate velocity field. It is shown that, in the inviscid version of this algorithm, each approximate vector of vorticity remains tangent to a material curve moving with the computed flow, with magnitude proportional to the stretching of this vortex line. This remains true even when time discretization is taken into account. It is explained that the expanding core vortex method converges to a system of equations different from the Navier-Stokes equations. Computations with the filament method of the inviscid interaction of two vortex rings are reported, both with single filaments in each ring and with a fully three-dimensional discretization of vorticity. The dependence on parameters is discussed, and convergence of the computed solutions is observed. 36 references, 4 figures.

50757 **Planar incompressible Yang-Mills magnetohydrodynamics.** Holm, D.D. (Los Alamos National Lab., NM (USA)); Kupershmidt, B.A. (Tennessee Univ., Tullahoma (USA). Space Inst.). *Lettere al Nuovo Cimento;* **40**: No. 3, 70-72(19 Mar 1984).

Equations of planar incompressible Yang-Mills magnetohydrodynamics are derived. Two related families of associated Hamiltonian structures are identified to semidirect product Lie algebras.

50758 **Consistent method for computing derived boundary quantities when the Galerkin FEM is used to solve thermal and/or fluids problems.** Gresho, P.M.; Lee, R.L. (California Univ., Livermore). pp 663-675 of Numerical methods in thermal problems. Volume 2. Swansea, Wales; Pineridge Press (1981). (CONF-810708—). Contract W-7405-ENG-48.

From 2. international conference on numerical methods in thermal problems; Venice, Italy (7 Jul 1981).

6450 High Energy Physics

REFER ALSO TO CITATION(S) 64500050446

50759 (DOE/ER/03509—20) **Research in elementary particle physics. Progress report, August 1, 1979-July 31, 1984.** (Florida State Univ., Tallahassee (USA). Dept. of Physics). 1984. Contract AS05-76ER03509. 296p. NTIS, PC A13/MF A01; 1; GPO Dep. File Number DE84016543.

In this document the High Energy Physics Group reviews its accomplishments and progress over the past five years. Also, as requested by DOE, the proposal for continuing research covers the next five years. Of course, we have been much more specific for the next few years since factors beyond our control will have a strong influence in our choice of research during the latter part of the five-year period.

50760 (INIS-SU—216) **Elementary particle physics. Proceedings of 17. Winter school of Leningrad Institute of Nuclear Physics.** (AN SSSR, Leningrad. Inst. Yadernoj Fiziki). 1982. 215p. NTIS (US Sales Only), PC A10/MF A01. File Number DE84780550.

Separate entries were made in the data base for the papers presented. (WHK)

50761 **High energy physics facilities. Hearing before the Subcommittee on Energy Development and Applications of the Committee on Science and Technology, US House of Representatives, Ninety-Eighth Congress, First Session, October 19, 1983.** Washington, DC, USA; Government Printing Office (1984). 658p.

Alvin W. Trivelpiece of the DOE Office of Energy Research and physicists from Stanford and Yale Universities testified on reports recommending the cancellation of the colliding beam accelerator (CBA) construction at Brookhaven National Laboratory and the initiation of physics experiments using the superconducting super collider (SSC). At issue were the funds already put into the CBA and the physics community's shift in support to the SSC. Trivelpiece discussed the controversy over facility funding and the uncertainties of frontier research programs before describing how funds would be allocated. The physicists discussed the background for the advisory panels recommendations. Two appendices with questions and responses and with additional material submitted for the record follow the testimony.

6451 Particle Interactions And Properties - Experimental

REFER ALSO TO CITATION(S) 64510050709, 50755

50762 (DESY—83-123) **Detectors for quark and gluon jets at high energies.** Wiik, B.H. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Dec 1983. 9p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84751509.

The author discusses the kinematics of quark and gluon jets observed in e^+e^--annihilation at PETRA and PEP energies.

50763 (DESY—84-001) **Measurement of R and search for the top quark in e^+e^- annihilation between 39.8 and 45.2 GeV.** Althoff, M.; Braunschweig, W.; Kirschfink, F.J.; Luebelsmeyer, K.; Martyn, H.U.; Peise, G.; Rimkus, J.; Rosskamp, P.; Sander, H.G.; Schmitz, D. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Jan 1984. 21p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84751529.

e^+e^- annihilation into hadrons was studied at c.m. energies between 39.8 and 45.2 GeV and a search was made for new heavy quarks. No evidence was found for the existence of a narrow state excluding the possible existence of the lowest vector toponium state in this mass range. A search for continuum production of heavy quarks lead to lower mass limits for new quarks of 22.0 GeV (esub(Q) = 2/3) and 21.0 GeV (esub(Q) = 1/3). Quarks are found to be pointlike, the corresponding mass parameter being larger than 288 GeV. A fit of the QCD and the electroweak contributions to R = sigmasub(tot)/sigmasub($\mu\mu$) yielded sin^{2}thetasub(W) = 0.30sub(-0.07)sup(+0.23).

50764 **(DESY—84-004) Evidence for local compensation of baryon number in e^+e^- annihilation.** Althoff, M.; Braunschweig, W.; Kirschfink, F.J.; Luebelsmeyer, K.; Martyn, H.U.; Rimkus, J.; Rosskamp, P.; Sander, H.G.; Schmitz, D.; Siebke, H. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Jan 1984. 13p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84751532.

We have studied at c.m. energies of 14, 22 and 30 - 36.7 GeV e^+e^- annihilation events in which the hadronic final state contains both a proton and an antiproton in the momentum range $1.0 < p < 5.0$ GeV/c. We find that such pairs are produced predominantly in the same jet and conclude that baryon-antibaryon production is dominated by a mechanism involving local compensation of baryon number.

50765 **(DESY—84-005) Experimental test of the flavor independence of the quark-gluon coupling constant.** Althoff, M.; Braunschweig, W.; Kirschfink, F.J.; Luebelsmeyer, K.; Martyn, H.U.; Rimkus, J.; Rosskamp, P.; Sander, H.G.; Schmitz, D.; Siebke, H. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Jan 1984. 20p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84751533.

Reconstruction of charged Dsup(*)'s produced inclusively in e^+e^- annhilations at c.m. energies near 34.4 GeV is accomplished in the decay modes Dsup(*+) -> $D^0\pi^+$ -> $K^-\pi^+\pi^0\pi^+$ and Dsup(*+) -> $D^0\pi^+$ -> $K^-\pi^+\pi^-\pi^+\pi^+$ and their charge conjugates. Using these and previously reported Dsup(*+) -> $D^0\pi^+$ -> $K^-\pi^+\pi^+$ and Dsup(*+) -> $D^0\pi^+$ -> $K^-\pi^+\pi^+$ + missing π^0 channels we present evidence for hard gluon bremsstrahlung from charm quarks and show that the ratio of the quark-gluon coupling constant of charm quarks to the coupling constant obtained in the average hadronic event, αsub(s)sup(c)/αsub(s) = 1.00 +- 0.20 +- 0.20. Our result provides evidence that the quark-gluon coupling constant is independent of flavor.

50766 **(DESY—84-008) New data on semihadronic decays of the tau lepton.** Achterberg, O.; D'Agostini, G.; Apel, W.D.; Engler, J.; Fluegge, G.; Forstbauer, B.; Fries, D.C.; Fues, W.; Gamerdinger, K.; Henkes, T. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Jan 1984. 24p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84751534.

Branching ratios for the decay tau -> ν + (n pions) with n >= 2 are presented. The new data include all possible charge configurations of the pion system and, in particular, final states containing one or several neutral pions. The data are compared with predictions from CVC (even number of pions in final state) and current algebra (odd number of pions). They strongly support the standard coupling of the tau to the weak charged current.

50767 **(DESY—84-032) Measurement of the photon structure function $F_2sup(\gamma)(x,Q^2)$.** Berger, C.; Deuter, A.; Genzel, H.; Lackas, W.; Pielorz, J.; Raupach, F.; Wagner, W.; Klovning, A.; Lillestoel, E.; Bussey, P.J. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Apr 1984. 17p. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.).

The structure function $F_2sup(\gamma)$ for a quasi-real photon has been measured in the Q^2 range 1.5 to 16 GeV^2 using 1417 multihadron events obtained with the PLUTO detector at PETRA. The x dependence of $F_2sup(\gamma)$ has been corrected for the effects of experimental resolution and incomplete acceptance. The result is compared with theoretical expectations. With weak theoretical assumptions, bounds of $65 < \Lambda$sub(anti Manti S) < 575 MeV are obtained for the QCD scale parameter.

50768 (INIS-mf—9052, pp 2) **Experimental neutrino physics at Serpukhov.** Lanius, K. (Institut fuer Hochenergiephysik der AdW der DDR). 1983. NTIS (US Sales Only), PC A99/MF A01. File Number TI84780548. (CONF-8309253—Absts.).

From 1. national congress of the physicists in Bulgaria; Sofia, Bulgaria (28 Sep 1983).

50769 (INIS-mf—9052, pp 24) **Electroneutrality of the neutron.** Kashukeev, N. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). 1983. (In Bulgarian). NTIS (US Sales Only), PC A99/MF A01. File Number TI84780548. (CONF-8309253—Absts.).

From 1. national congress of the physicists in Bulgaria; Sofia, Bulgaria (28 Sep 1983).

50770 **(RL—83-123) Charm photoproduction at 20 GeV.** Abe, K.; Bacon, T.C.; Ballam, J. (Rutherford Appleton Lab., Chilton (UK)). Dec 1983. 41p. (SLAC-PUB—3271; TUHEL—83-21). NTIS (US Sales Only), PC A03/MF A01. File Number DE84703114.

Sixty-two events have been observed in an exposure of the SLAC Hybrid Facility to a backward scattered laser beam. Based on 22 neutral and 21 charged decays the charmed meson lifetimes have been measured to be tausub(D)o = (6.8sub(-1.8)sup(+2.3)) x 10^{-13}s, tausub(D)+- = (7.4sub(-2.0)sup(+2.3)) x 10^{-13}s and their ratio tausub(D)+-/tausub(D)o = 1.1sub(-0.3)sup(+0.6). The inclusive charm cross section at a photon energy of 20 GeV has been measured to be (56sub(-23)sup(+24) nb). Evidence is presented for a non D D component to charm production, consistent with 35 +- 20% Λ^+sub(c) production and some D^{*+-} production. No unambiguous F decays have been found.

50771 **Consistency between two recent experiments on $\Sigma p \to ne\nu$.** Bohm, A.; Kielanowski, P.; Garcia, A. (Center for Particle Theory, The University of Texas at Austin, Austin, Texas 78712). *Physical Review* [*Section*] *D: Particles and Fields;* **30**: No. 1, 231-233(1 Jul 1984). Contract AS05-76ER03992.

It is shown that the WA2 experiment measuring the electron energy spectrum in $\Sigma^- \to ne\nu$ and the Argonne—Chicago—Ohio State experiment measuring the electron asymmetry in $\Sigma^- \to ne\nu$ are consistent with each other, if large pseudotensor form factors are present.

6452 Particle Interactions And Properties - Theoretical

REFER ALSO TO CITATION(S) 64520050711, 50762, 50765, 50794, 50807

50772 **(DESY—83-125) Multiple bremsstrahlung in gauge theories at high energies. Pt. 3.** Berends, F.A.; Kleiss, R.; de Cuasmaecker, P.; Gastmans, R.; Troost, W.; Wu, T.T. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Dec 1983. 18p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84751511.

We present a method for calculating the various spin amplitudes for QED processes in which an arbitrary number of photons is radiated in directions nearly parallel to the fermion directions. This is accomplished by introducing explicit polarization vectors for the photons and by working in the high energy limit, where finite mass effects are treated in leading order.

50773 **(DESY—83-126) Multiple bremsstrahlung in gauge theories at high energies. Pt. 4.** Berends, F.A.; Kleiss, R.; de Cuasmaecker, P.; Gastmans, R.; Troost, W.; Wu, T.T. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Dec 1983. 25p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84751512.

We calculate the helicity amplitudes and the cross section for the process $e^+e^- \to 4\gamma$ in the high-energy limit. The resulting expressions are presented in a form which allows an easy numerical evaluation. They are valid for the kinematical configurations where at most two photons are emitted in directions nearly parallel to the lepton directions.

50774 (DESY—83-127) Model dependence of the determination of the strong coupling constant in second order QCD from e^+e^--annihilation into hadrons. Achterberg, O.; D'Agostini, G.; Apel, W.D.; Engler, J.; Fluegge, G.; Forstbauer, B.; Fries, D.C.; Fues, W.; Gamerdinger, K.; Henkes, T. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Dec 1983. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84751513.

Hadronic events obtained with the CELLO detector at PETRA are compared with second order QCD predictions using different models for the fragmentation of quarks and gluons into hadrons. We find that the model dependence in the determination of the strong coupling constant persists when going from first to second order QCD calculations.

50775 (DESY—83-129) Hadron spectrum in lattice QCD. Schierholz, G. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Dec 1983. 30p. (CONF-8306136—3). NTIS (US Sales Only), PC A03/MF A01. File Number DE84751536.

From International symposium on quarks and nuclear structure; Bad Honnef, F.R. Germany (13 Jun 1983).

Also presented at workshop on nonperturbative quantum chromodynamics, Oklahoma State Univ., Stillwater (USA), March 1983.

I give a brief introduction to lattice QCD and discuss some of the recent calculations of the hadron mass spectrum. I also address the question of spontaneous chiral symmetry breaking which most obviously influences the character of the hadron spectrum.

50776 (DESY—83-131) Introduction to ν quarkonium physics. Fridman, A. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Dec 1983. 71p. NTIS (US Sales Only), PC A04/MF A01. File Number DE84751537.

We focus our interest on the ν family observed as s-channel resonances in e^+c^- collisions. Four resonances have been discovered in e^+e^- interactions in a c.m. energy of 9.4 to 10.6 GeV, to which the symbols ν, ν', ν'' and ν''' have been initially attributed.

50777 (DESY—84-003) Total cross sections for two off shell photons. Maor, U.; Alexander, G.; Gotsman, E. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Jan 1984. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84751531.

The EVDM and factorization technique are extended to the case of two tagged photons. The results obtained from both methods are remarkably close, and in very good agreement with the recent measurements made by the PLUTO collaboration at PETRA. Predictions are made for higher values of Q^2 and P^2, where future experiments are planned, and these are compared with the relevant QCD calculations.

50778 (DESY—84-019) Merging of jets. Sjoestrand, T. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Feb 1984. 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84751921.

In perturbative QCD matrix elements, the invariant mass of parton pairs is normally peaked at low values, due to the singularities of the q -> qg and g -> gg subprocesses. Whereas pairs at large invariant masses give rise to separately visible jets, one may expect a continuous merging back into one single jet, q or g, when the qg or gg invariant mass becomes small. Within the framework of string fragmentation, we outline an explicit model in which this takes place, and study some of the resulting properties.

50779 (INIS-mf—9052, pp 11) Mass and form factor effects in spectrum and width of the semileptonic decays of charmed mesons. Fakirov, D. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). 1983. (In Bulgarian). NTIS (US Sales Only), PC A99/MF A01. File Number TI84780548. (CONF-8309253—Absts.).

From 1. national congress of the physicists in Bulgaria; Sofia, Bulgaria (28 Sep 1983).

50780 (INIS-mf—9052, pp 12) Cross sections and multiplicity of charged particles scattered at high energies. Mavrodiev, S. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika); Drenska, S. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1983. (In Bulgarian). NTIS (US Sales Only), PC A99/MF A01. File Number TI84780548. (CONF-8309253—Absts.).

From 1. national congress of the physicists in Bulgaria; Sofia, Bulgaria (28 Sep 1983).

50781 (INIS-mf—9052, pp 6) W K B approximation for solution of the quasipotential equation with a linear potential. Atanasov, A.; Bankova, S. (Plovdivski Univ. (Bulgaria)). 1983. (In Bulgarian). NTIS (US Sales Only), PC A99/MF A01. File Number TI84780548. (CONF-8309253—Absts.).

From 1. national congress of the physicists in Bulgaria; Sofia, Bulgaria (28 Sep 1983).

50782 (INIS-mf—9064, pp 75) Cosmological constraints on heavy neutrino lifetimes. Granek, H.; McKellar, B.H.J. (Melbourne Univ., Parkville (Australia). School of Physics). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50783 (INIS-mf—9064, pp 17) Comparison of various observations of M*sub($\mu\pi$) (0.429). Ramm, C.A. (Melbourne Univ., Parkville (Australia). School of Physics). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50784 (INIS-SU—216, pp 3-10) Long-range interaction related to exchange by massless Goldstone particles and methods of its detection. Ansel'm, A.A. 1982. (In Russian). NTIS (US Sales Only), PC A10/MF A01. File Number TI84780550.

In Elementary particle physics. Proceedings of 17. Winter school of Leningrad Institute of Nuclear Physics.

The possibility of existence of stable massless Goldstone particle O+- ("arion") with semiweak interaction with fermions is under discussion. It is noted that for the purpose of arion long-range interaction detection, it is possible to use different detection methods of a weak magnetic field in the experiment if the true magnetic field produced by oriented spins is suppressed by superconducting shielding. The effect magnitude is determined from the product of "arion magnetic moments" of interacting particles.

50785 (INIS-SU—216, pp 11-136) Heavy quark physics. Khoze, V.A.; Shifman, M.A. 1982. (In Russian). NTIS (US Sales Only), PC A10/MF A01. File Number TI84780550.

In Elementary particle physics. Proceedings of 17. Winter school of Leningrad Institute of Nuclear Physics.

A review of the data obtained during the last five years in the heavy quark physics is presented. The theory of heavy quarkoniums are under discussion. The following problems are considered: a mass spectrum of heavy particles, their leptonic and hadronic decays, effects caused by weak interactions. Methods of quantum chromodynamics perturbation theory are applied to processes with heavy quarks. A problem of heavy hadron spectrum in the e^+e^- annihilation is studied and some representations of quantum chromodynamics on hadron yields in quarkonium decays are also presented. Properties of toponium built up from tt^- quarks are briefly outlined.

50786 (UWThPh—84-06) Proton decay in the framework of a non-relativistic potential model. Falkensteiner, F.; Lucha, W.; Schoeberl, F. (Vienna Univ. (Austria)). 1984. 28p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84703112.

We apply a potential model to the proton decay, which has been shown to be very successful in predicting mesons as well as baryons. The meson wave functions are obtained by numerical solu-

tion of the Schroedinger equation while the baryon wave functions are obtained by a variational method based on a superposition of Gaussian trial functions. For the calculation of the proton decay no additional assumption or input is needed. We calculate the nucleon decay branching ratios for different grand unified theories, going beyond the naive assumption of a unique 'psisub(N)(O)'^{2} for all decay modes.

50787 **(UWThPh—84-16) Semi-phenomenological approach to beauty-decay.** Pietschmann, H.; Rupertsberger, H. (Vienna Univ. (Austria)). 1984. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703113.

B-decay matrix elements are computed with the help of spectral functions which can be related to experimentally accessible quantities. In this way, the standard analysis (on the basis of a simple quark model) is supported and its systematic uncertainties can be estimated. This corroborates the values of the Kobayashi-Maskawa matrix elements derived from B-lifetime measurements.

50788 **Limits on tau composite structure from polarized Z^0 decay.** Reid, J.; Samuel, M.; Milton, K.A.; Rizzo, T.G. (Department of Physics, Oklahoma State University, Stillwater, Oklahoma 74078). *Physical Review* [*Section*] *D: Particles and Fields;* **30**: No. 1, 245-247(1 Jul 1984).

We extend the recent analysis of Silverman and Shaw on limits of possible composite structure of the tau to the case where the tau's result from polarized Z^0 decay. We allow for both anomalous-magnetic-moment-(κ/sub a/) and CP-violating electric-dipole-moment (κ/sub a/) couplings of the tau's to the Z^0. With a Z^0 factory and longitudinally polarized e^{+-} beams it may be possible to set limits on κ/sub a/ and κ/sub V/ at the 10^{-3} level.

50789 **Nonstandard fermion mass matrices and nucleon decay.** Reiss, D.B.; Rudaz, S. (School of Physics and Astronomy, University of Minnesota, Minneapolis, Minnesota 55455). *Physical Review* [*Section*] *D: Particles and Fields;* **30**: No. 1, 118-122(1 Jul 1984). Contract AC02-82ER40051.

We discuss how nonstandard fermion mass matrices (with hierarchical eigenvalues) lead to mixing effects in nucleon decay which can enhance the branching ratios of naively unexpected decay modes, and could suppress the rates for $N \to e^+ +$ nonstrange hadron(s).

50790 **1sup(+-+) resonances in γγ collisions.** Renard, F.M. (Stanford Linear Accelerator Center, CA (USA)). *Nuovo Cimento* [*Sezione*] *A;* **80**: No. 1, 1-11(1 Mar 1984).

We show that 1sup(+-+) resonances can be observed at an appreciable rate in tagged e^+e^- experiments at low q^2. We discuss the (qanti q), (qqanti qanti q), (qanti qg), (gg) and (ggg) spectroscopy and compute the corresponding γγsup(*) partial widths.

50791 **Meson-exchange Hamiltonian for nucleon-nucleon scattering up to 2 GeV.** Lee, T.S.H. (Argonne National Lab., IL (USA)). pp 63 of Few body problems in physics. Vol. 2. Contributed papers. Zeitnitz, B. (Karlsruhe Univ. (T.H.) (Germany, F.R.); Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)). Amsterdam, Netherlands; North-Holland (1984). (CONF-830862—). Contract W-31-109-ENG-38.

From 10. international conference on few-body problems in physics; Karlsruhe, F.R. Germany (21 Aug 1983).
Published in summary form only.

50792 **Scattering and cluster properties in relativistic models of directly interacting confined quarks.** Polyzou, W.N. (Iowa Univ., Iowa City (USA). Dept. of Physics and Astronomy); Coester, F. (Argonne National Lab., IL (USA)). pp 651-652 of Few body problems in physics. Vol. 2. Contributed papers. Zeitnitz, B. (Karlsruhe Univ. (T.H.) (Germany, F.R.); Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)). Amsterdam, Netherlands; North-Holland (1984). (CONF-830862—). Contract AC02-81ER40038;W-31-109-ENG-38.

From 10. international conference on few-body problems in physics; Karlsruhe, F.R. Germany (21 Aug 1983).
Published in summary form only.

6453 Particle Invariance Principles And Symmetries

REFER ALSO TO CITATION(S) 64530050708, 50804, 50809, 50812, 50815

50793 **(INIS-mf—9052, pp 7) Multiplet classification of the reducible elementary representations of real semisimple Lie groups.** Dobrev, V. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). 1983. (In Bulgarian). NTIS (US Sales Only), PC A99/MF A01. File Number TI84780548. (CONF-8309253—Absts.).

From 1. national congress of the physicists in Bulgaria; Sofia, Bulgaria (28 Sep 1983).

50794 **(INIS-mf—9052, pp 4) Gauge invariance and selection rules for elementary particles.** Nguen Mong Zao (Saigon Univ. (Viet Nam). Dept. of Physics). 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number TI84780548. (CONF-8309253—Absts.).

From 1. national congress of the physicists in Bulgaria; Sofia, Bulgaria (28 Sep 1983).

50795 **(INIS-mf—9064, pp 31) Chiral symmetry and the U(1) problem.** Christos, G.A. (Australian National Univ., Canberra. Research School of Physical Sciences). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50796 **(INIS-mf—9064, pp 52) Wigner coefficients for semi-simple lie groups: a pattern calculus for O(n) and U(n).** Gould, M.D. (Western Australia Univ., Nedlands). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50797 **(INIS-mf—9064, pp 66) P_{11} channel and the effects of crossing symmetry.** McLeod, R.J. (Flinders Univ. of South Australia, Bedford Park. School of Physical Sciences). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50798 **Magnetic monopoles and fractional Witten indices.** Yamagishi, H. (Center for Theoretical Physics, Laboratory for Nuclear Science and Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Physical Review* [*Section*] *D: Particles and Fields;* **29**: No. 12, 2975-2976(15 Jun 1984). Contract AC02-76ER03069.

The monopole-fermion system is shown to provide an example of a fractional Witten index. The discontinuity exhibited by the massless case is reminiscent of that for the eta invariant.

50799 **Supersymmetry and supergravity.** Zumino, B. (Lawrence Berkeley Lab., CA (USA)). *Physics Reports: A Review Section of Physics Letters (Section C);* **104**: No. 2-4, 113-128(Feb 1984). (CONF-8211181—). Contract AC03-76SF00098.

From 18. Solvay conference on physics; Austin, TX, USA (1 Nov 1982).

A discussion of recent attempts to relate N = 1 Supersymmetry and Supergravity to particle phenomenology. 66 refs.

6454 Field Theory

REFER ALSO TO CITATION(S) 64540050772, 50781, 50789, 50795, 50799, 50980

50800 (DESY—83-128) Kaehler's geometric description of Dirac fields. Goeckeler, M.; Joos, H. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Dec 1983. 24p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84751535.

Lecture given at the 1983 Cargese Summer School on 'progress in gauge fields'.

A differential geometric generalization of the Dirac equation due to E. Kaehler seems to be an appropriate starting point for the lattice approximation of matter fields. It is the purpose of this lecture to illustrate several aspects of this approach.

50801 (DESY—84-002) Monte Carlo calculation with unquenched Wilson-Fermions. Montvay, I. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Jan 1984. 13p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84751530.

A Monte Carlo updating procedure taking into account the virtual quark loops is described. It is based on high order hopping parameter expansion of the quark determinant for Wilson-fermions. In a first test run Wilson-loop expectation values are measured on 6^4 lattice at $\beta=5.70$ using 16sup(th) order hopping parameter expansion for the quark determinant.

50802 (DESY—84-018) Definition and general properties of the transfer matrix in continuum limit improved lattice gauge theories. Weisz, P.; Luescher, M. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Feb 1984. 23p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84751920.

When operators of dimension 6 are added to the standard Wilson action in lattice gauge theories, physical positivity is lost in general. We show that a transfer matrix can nevertheless be defined. Its properties are, however, unusual: complex eigenvalues may occur (leading to damped oscillatory behaviour of correlation functions), and there are always contributions in the spectral decomposition of two-point functions that come with a negative weight.

50803 (INIS-mf—8884) Current algebra and the local nature of symmetries in local quantum theory. Doplicher, S. (Rome Univ. (Italy). Ist. di Matematica). (Bielefeld Univ. (Germany, F.R.). Zentrum fuer Interdisziplinaere Forschung). 1984. vpp. NTIS (US Sales Only), PC A02/MF A01. File Number DE84780549.

In this report we mainly discuss the problem of finding local observables which measure the charges in a volume smaller than their localization region, in particular providing the existence of local observables with a specific physical interpretation. In the same way we can also establish the existence of a version of the current algebra structure. Similar local observables can be constructed for the energy-momentum; we also comment on the local implementation of supersymmetries.

50804 (INIS-mf—9052, pp 5) Quantum effects in the Schwinger model. Ilieva, N.; Pervushin, V. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1983. (In Bulgarian). NTIS (US Sales Only), PC A99/MF A01. File Number TI84780548. (CONF-8309253—Absts.).

From 1. national congress of the physicists in Bulgaria; Sofia, Bulgaria (28 Sep 1983).

50805 (INIS-mf—9064, pp 42) Soliton bags in quantum field theory. Williams, A.G.; Cahill, R.T. (Flinders Univ. of South Australia, Bedford Park). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50806 (INIS-mf—9064, pp 49) Gluon propagator in quantum chromodynamics. Slim, H.A. (Western Australia Univ., Nedlands. Dept. of Physics). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50807 (INIS-mf—9064, pp 36) QCD and the spectroscopy of quarkonia. Gorman, R.M.; McKellar, B.H.J. (Melbourne Univ., Parkville (Australia). School of Physics). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50808 (INIS-mf—9064, pp 23) Rho decay in the cloudy bag model. Dodd, L.R. (Adelaide Univ. (Australia)). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50809 Chiral-symmetry breaking in a composite model with scalars based on lattice gauge theory. Chen, P.; Chiu, C.B. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305). *Physical Review [Section] D: Particles and Fields;* **30**: No. 4, 797-808(15 Aug 1984). Contract AC03-76SF00515;AS05-76ER03992.

In a composite model, based on the SO(3) gauge group, in which there are both fermion and scalar fundamental fields, we determine whether there is spontaneous breaking of chiral symmetry and look for the mass gap between the ground state and the one composite-fermion state. The chiral symmetry is realized in the strong-coupling lattice Hamiltonian with the fundamental fermions being massless and fundamental scalars being massive. This calculation is based on the mean-field approximation to the state wave functions. Similar to the calculations of Quinn, Drell, and Gupta in models without scalars, we also find that the chiral symmetry is spontaneously broken, and the composite fermions are massive. The extension of our calculation to SO(N) cases is shown to be straightforward.

50810 Spectral asymmetry on an open space. Niemi, A.J.; Semenoff, G.W. (The Institute for Advanced Study, Princeton, New Jersey 08540). *Physical Review [Section] D: Particles and Fields;* **30**: No. 4, 809-818(15 Aug 1984). Contract AC02-76ER02220.

The spectral asymmetry is evaluated for a family of Dirac operators interacting with a topological background field and defined on an open infinite space. For these operators the spectral asymmetry is given by an integral over a local quantity that relates only to the homotopy properties of the background field. zeta-function regularization is employed and a possible simple pole in the limit where the regulator is removed is shown to vanish. The spectral asymmetry can be computed in a closed form in specific models. This is exemplified in various cases involving solitons, vortices, magnetic monopoles, and instantons as background fields.

50811 Fermion zero modes on parallelized and squashed group manifolds. Wu, X. (Center for Theoretical Physics, Laboratory for Nuclear Science and Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Physical Review [Section] D: Particles and Fields;* **29**: No. 12, 2769-2772(15 Jun 1984). Contract AC02-76ER03069.

It is shown that the Cartan-Schouten parallelism should be replaced by a metric-consistent parallelism on a parallelized and squashed group manifold. If the isometry is G x G' (G'⊂G), then spin-half fermion zero modes only have G' as the gauge symmetry. Their quantum numbers are determined by a reduction of the representation γ under G', where γ is an irreducible representation of G with the highest weight (1,1,...,1).

50812 **Hypercolor unification without cosmological domains.** Yildiz, A. (Department of Physics and College of Engineering, Boston University, Boston, Massachusetts 02215). *Physical Review* [*Section*] *D: Particles and Fields;* **29**: No. 12, 2977-2978(15 Jun 1984). Contract AC02-83ER40118.

Grand unified models are considered in relation to the cosmological constraint of vanishing domain walls, to solving the strong-CP problem and hypercolor unification. A semisimple theory of $[SU(9)]^3$ is found to be the best example.

50813 **Path-integral derivation of the chiral anomalies of Dirac fermions coupled to gauge and gravitational fields in even space-time dimensions.** Gipson, J.M. (Department of Physics, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061). *Physical Review* [*Section*] *D: Particles and Fields;* **29**: No. 12, 2989-2992(15 Jun 1984). Contract AS05-80ER10713.

The anomalies associated with chiral rotations of Dirac fermions coupled to vector gauge fields in a curved space of arbitrary even dimension are derived within the path-integral framework. Special cases of the general formula agree with all results previously obtained.

50814 **Bound state Regge trajectories in N=8 supergravity.** Grisaru, M.T.; Schnitzer, H.J. (California Inst. of Technology, Pasadena, CA 91125). pp 169-175 of Unification of the fundamental particle interactions II. Vol. 15. Ellis, J.; Ferrara, S. New York, NY, USA; Plenum Publishing Corp. (1983). (CONF-8110291—).

From Europhysics study conference; Erice, Italy (6 Oct 1981).

Recent work to investigate the existence of bound states in the dynamics of N=8 supergravity is reviewed. The method of investigation described indicates that "current multiplet" states (hypothesized by EGMZ) do exist as two-preon bound states and that infinite sets of multipreon bound states may also exist. Previous work put into studying Regge poles in Yang-Mills theories is reviewed. An approach is outlined which proves that Regge poles and trajectories exist and that some of them correspond to original preons.

50815 **Fermions in the desert.** Ramond, P. (Physics Dept., Univ. of Florida, Gainesville, FL 32611). pp 467-474 of Unification of the fundamental particle interactions II. Vol. 15. Ellis, J.; Ferrara, S. New York, NY, USA; Plenum Publishing Corp. (1983). (CONF-8110291—).

From Europhysics study conference; Erice, Italy (6 Oct 1981).

The possibility of adding vector-like fermions with anomalously low masses to standard Grand Unified theories such as SU(5) and SO(10) is studied. The fermions are hypothesized to be relics of GUTs breaking at 10^{-4} found at the edge of the "desert". The phenomenology of these fermions is reviewed, models are derived, and the effects of the fermions on proton lifetime, GIM mechanism, and CP violation are considered. The existence of these extra delta I = O fermions is likely since all models beyond the minimal SU(5) predict them.

50816 **Some self-dual SO(3) solutions of the Yang-Mills equation and a note on harmonic maps.** Langer, T. Berkeley, CA, USA; Univ. of California (1983). 53p. University Microfilms Order No. 83-28,952.Contract AT03-80ER10617.

Thesis (Ph. D.).

In Part One, the 't Hooft ansatz for constructing self-dual solutions of the SU(2) Yang-Mills equation on S^4 is generalized. The result is a family of explicity self-dual SO(3) connections on any 1/2-conformally flat manifold of positive scalar curvature. Implications and examples are discussed. Part Two contains a simple reformulation of the harmonicity condition for a map from a surface to a complex Grassmannian.

6455 Scattering Theory

REFER ALSO TO CITATION(S) 64550050827

65 PHYSICS. II.

50817 **(INIS-mf—9052) First national congress of the physicists in Bulgaria 28 September - 1 October 1983, Sofia. Abstracts of reports and short communication.** (Druzhestvo na Fizitsite v Bylgariya, Sofia; Bylgarska Akademiya na Naukite, Sofia. Edinen Tsentyr po Fizika; Sofia Univ. (Bulgaria). Fizicheski Fakultet). 1983. 652p. (In Bulgarian). (CONF-8309253—Absts.). NTIS (US Sales Only), PC A99/MF A01. File Number DE84780548.

From 1. national congress of the physicists in Bulgaria; Sofia, Bulgaria (28 Sep 1983).

Published in summary form.

Individual entries were made in the data base for the abstracts and short communications included. (WHK)

6510 Nuclear Physics

REFER ALSO TO CITATION(S) 65100050456

50818 **(AD-A—141244/4) Influence of microturbulence on early time HANE structure. Memorandum report.** Huba, J.D. (Naval Research Lab., Washington, DC (USA)). 30 Apr 1984. 28p. (NRL-MR—5305). NTIS, PC A03/MF A01.

This document shows that microturbulence can have a direct effect on the evolution of interchange instabilities. A simple, two-fluid model of the Rayleigh-Taylor instability is considered which incorporates the effects of microturbulence through anomalous electron-ion and ion-ion collisions. A set of two-dimensional nonlinear mode coupling equations is developed. It is demonstrated that the intermediate wavelength regime of the instability can saturate by transferring energy from the growing modes to the damped modes because of the nonlinear E x B motion. A crucial point in the analysis is that anomalous electron-ion collisions provide the dissipation mechanism for the damped modes. Applications of this theory to early time HANE(High Altitude Nuclear Event) structuring are discussed.

50819 **(BNL—51778) NEANDC specialists meeting on yields and decay data of fission product nuclides.** Chrien, R.E.; Burrows, T.W. (eds.). (Brookhaven National Lab., Upton, NY (USA)). 1983. Contract AC02-76CH00016. 573p. (CONF-8310104—). NTIS, PC A24/MF A01; 1; GPO Dep. File Number DE85000967.

From Specialists meeting on yields and decay data of fission product nuclides; Upton, NY, USA (24 Oct 1983).

Separate abstracts were prepared for the 29 papers presented. Workshop reports on decay heat, fission yields, beta- and gamma-ray spectroscopy, and delayed neutrons are included. An appendix contains a survey of the most recent compilations and evaluations containing fission product yield, fission product decay data, and delayed neutron yield information. (WHK)

50820 **(DOE/ER/03624—25) Triangle Universities Nuclear Laboratory annual report, TUNL XXIII, September 1, 1983-June 30, 1984.** (Duke Univ., Durham, NC (USA); North Carolina Univ., Chapel Hill (USA); North Carolina State Univ., Raleigh (USA)). 1984. Contract AS05-76ER03624;AS05-76ER02408;AC05-76ER01067. 167p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE85001906.

The varied research programs described in this report reflect a decision by TUNL to devote its major resources to the study of the multiple facets of nuclear structure which can be probed through light-ion and neutron induced nuclear reactions. At TUNL particular emphasis is placed on reactions induced by polarized protons, deuterons, and neutrons. We also continue a major commitment to the study of the statistical properties of nuclear structure revealed by elastic and inelastic scattering experiments using ultra

high resolution proton beams. A third major laboratory commitment involves measurements of fast neutron cross sections required by the Department of Energy's program for the development of controlled thermonuclear fusion. The major accelerator facilities of the laboratory include a model FN tandem Van de Graaff accelerator and a 15 MeV fixed-energy negative ion cyclotron injector. In addition to the broad experimental program which is described in detail in this report, TUNL continues to refine and improve existing experimental techniques and to add new capabilities to serve our faculty and to challenge our students. Current programs which are expected to have a significant impact on our physics program are: (1) to improve the low energy bunching system; (2) to improve the Lamb shift polarized ion source; (3) to develop an injector cyclotron bunching system; (4) to obtain a new intense polarized ion source; (5) to study long term polarized ion source improvements; and (6) to consider acceleration of polarized beams into the TUNL cyclotron. (WHK)

50821 **(DOE/ER/40007—26) Nuclear chemistry progress report.** (Indiana Univ., Bloomington (USA)). Sep 1984. Contract AC02-81ER40007. 56p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85000062.

The activities of the nuclear chemistry group at Indiana University during the period September 1, 1983 to August 31, 1984, are summarized. The primary thrust of our research program has continued to be the investigation of damped collision mechanisms at near-barrier energies and of linear momentum and energy transfer in the low-to-intermediate energy regime. In addition, during the past year we have initiated studies of complex fragment emission from highly excited nuclei and have also completed measurements relevant to understanding the origin and propagation of galactic cosmic rays. Equipment development efforts have resulted in significantly improving the resolution and solid-angle acceptance of our detector systems. The experimental program has been carried out at several accelerators including the Indiana University Cyclotron Facility, the Lawrence Berkeley Laboratory SuperHILAC, the Holifield Heavy-Ion Research Facility and the National Superconducting Cyclotron Laboratory at Michigan State University. Publications and activities are listed. (WHK)

50822 **(GSI—83-14) Report of the expert committee Nuclear physics and heavy ion research 1980-1982.** (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Dec 1983. 43p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE84751514.

This report of the expert committee 'Nuclear Physics and Heavy Ion Research' for the years 1980-1982 is based on the reports of the results of the project leaders of the single groups. The presentation of the results in this report is confined to examples and claims no completeness. The nuclear physics work in the framework of the coordinated research are completed by the activities of the centers and the Max-Planck institutes which are performed in the framework of their own research and development programs.

50823 **(INIS-mf—9064) 10th AINSE nuclear physics conference, held from 6th-8th February 1984 at the Australian National University, Canberra.** (Australian Inst. of Nuclear Science and Engineering, Lucas Heights). 1984. 101p. (CONF-840216—). NTIS (US Sales Only), PC A06/MF A01. File Number DE84780621.

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

Separate entries were made in the data base for the papers presented. (WHK)

50824 **(LA—10069-PR) Applied nuclear data research and development. Semiannual progress report, April 1-September 30, 1983.** Arthur, E.D. (comp.). (Los Alamos National Lab., NM (USA)). Jun 1984. Contract W-7405-ENG-36. 105p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE84016000.

This progress report describes the activities of the Los Alamos Nuclear Data Group for April 1, 1983 through September 30, 1983. Topics covered include theory and evaluation of nuclear cross sections; nuclear cross-section processing and testing; neutron activation; fission products, and actinides; and core neutronics code development in support of LMFBR carbide core assessment. (GHT)

50825 **(NEANDC(E)—242-U(Vol.5)) Progress report on nuclear data research in the Federal Republic of Germany. For the period April 1, 1982 to March 31, 1983.** (Nuclear Energy Agency, 75 - Paris (France)). 1983. 88p. (INDC(GER)—25-L; FIZ-KA—6). NTIS (US Sales Only), PC A05/MF A01. File Number DE84703122.

This report has been prepared to promote exchange of nuclear data research information between the Federal Republic of Germany and the other member states of NEA and IAEA. It brings together progress reports from KfK Karlsruhe, KFA Juelich, the Universities of Hamburg, Kiel, Koeln, Mainz, Marburg, Muenchen and Stuttgart, as well as from PTB Braunschweig and FIZ Karlsruhe. The emphasis in the work reported here has been on measurement, evaluation and compilation of application-oriented nuclear data, such as those relevant to fission and fusion reactor technologies, development of intense spallation neutron sources, production of medically important short-lived radioisotopes, etc. Each contribution is presented under the laboratory heading where the work was done.

6511 Experimental Techniques

50826 (INIS-mf—9064, pp 11) **Future directions in intermediate energy nuclear physics.** Spicer, B.M. (Melbourne Univ., Parkville (Australia). School of Physics). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50827 **(NEANDC(E)—230-L) Transformation of angular scattering probabilities between reference systems: survey and numerical analysis.** Bersillon, O.; Schett, A.; Caput, B. (Nuclear Energy Agency, 75 - Paris (France)). Oct 1983. 281p. (INDC(FR)—59-L). NTIS (US Sales Only), PC A13/MF A01. File Number DE84703118.

The present study deals with the transformation of angular scattering probabilities between the laboratory- and center-of-mass-system, in particular it deals with the transformation matrices T, T^{-1}. A survey of the methods for the calculation of these matrices shows that none of the methods is satisfactory either as far as mathematical analysis or numerical exploration is concerned. This work is thus centered on the elaboration and testing of a reliable (accuracy controlled) and efficient method to compute the transformation matrices T, T^{-1}. Extensive calculations and performance-comparisons of the various methods show that the so-called Taylor series method is manifestly superior as regards reliability (round-off stability) and efficiency (computing time). The Taylor series method has been applied to calculate tables of the matrices T, T^{-1}. It turns out that the corresponding tables found in literature are to be discarded as they are too erroneous. Moreover, the matrices given in ENDF/B4 file for light elements have to be used with precaution. That is also demonstrated by comparative neutron transport calculations across deuterium-spheres. Besides results of numerical analysis, properties of the matrices T, T^{-1}, new relations of integrals as well as new recurrence relations are presented and ramification to other mathematical disciplines are discussed.

6512 Nuclear Properties And Reactions, A=1-5

50828 **(BONN-HE—84-8) Measurement of coherent π^0 photoproduction on ^{3}He and ^{3}H in the resonance region.** Bellinghausen, B.; Gassen, H.J.; Reese, E.; Reichelt, T.; Stipp, P. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.). Mar 1984. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84752166.

Neutral pion photoproduction has been measured on ^{3}He and ^{3}H nuclei in the $\Delta(1232)$ resonance region. Resonance averaged cross-sections are presented as function of momentum transfer and compared to theoretical calculations.

50829 (INIS-mf—9064, pp 85) **Theoretical calculation of the forward cross section for deuteron photodisintegration at low energies.** Jaus, W. (Zurich Univ. (Switzerland)); Woolcock, W.S. (Australian National Univ., Canberra. Research School of Physical Sciences). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50830 (INIS-mf—9064, pp 70) **Photonuclear reactions in light nuclei.** Thompson, M.N. (Melbourne Univ., Parkville (Australia). School of Physics). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50831 (INIS-mf—9064, pp 67) **Comparison of neutron-deuteron and proton-deuteron analysing powers.** Garrett, R.; Chisholm, A. (Auckland Univ. (New Zealand). Dept. of Physics). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50832 (INIS-mf—9064, pp 87) **Tensor polarisation t_{20} in pion-deuteron elastic scattering.** Ulbricht, J.; Gruebler, W.; Konig, V.; Schmelzbach, P.A.; Elsener, K.; Merdzan, M.; Schweizer, C. (Eidgenoessische Technische Hochschule, Zurich (Switzerland). Lab. fuer Kernphysik); Chisolm, A. (Auckland Univ. (New Zealand). Dept. of Physics). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

6513 Nuclear Properties And Reactions, A=6-19

REFER ALSO TO CITATION(S) 65131050847

50833 **(CONF-8406156—4) Chaos near the Coulomb barrier. Nuclear molecules.** Strayer, M.R. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 23p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001280.

From International conference on fusion reactions below the Coulomb barrier; Cambridge, MA, USA (13 Jun 1984).

The present work examines in detail the classical behavior of the $\alpha + {}^{14}C$ and the ${}^{12}C + {}^{12}C(0^+)$ collison at energies near the Coulomb barrier. The long-time motion of the compound nuclear system is identified in terms of its classical quasiperiodic and chaotic behavior. The consequences of this motion are discussed and interpreted in terms of the evolution of the system along a dynamical energy surface. 45 references.

50834 **(CONF-8409149—1) Nuclear molecules in TDHF.** Strayer, M.R. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 16p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001124.

From 5. Adriatic international conference on nuclear physics: fundamental problems in heavy-ion collisions; Hvar, Yugoslavia (24 Sep 1984).

The quasiperiodic motion in ${}^{24}Mg$, which experimentally displays a type of molecular structure is studied using the time-dependent Hartree-Fock approximation. The TDHF method addresses the question of molecular formation from a microscopic view which provides both a geometrical (classical) picture of the molecule, as well as characteristic information on the rotational and vibrational structure of the molecule. The most extensive experimental evidence for the existence of nuclear molecules lies in the narrow resonances observed in the ${}^{12}C + {}^{12}C$ reactions near the Coulomb barrier. A large number of experimental data has been amassed, and the most successful organization of these data is in terms of the U(4) model of Iachello. The representation of the data in terms of this model suggests that the molecule involves a structure related to the 7.08 MeV 0^+ state of ${}^{12}C$. This state has a well-established cluster structure and is approximately given as a HF shape isomer of ${}^{12}C$. The energy as a function of deformation and the density contours for both the ground state ${}^{12}C$ and the carbon isomer are shown. The present work examines in detail the classical behavior of the ${}^{12}C + {}^{12}C(0^+)$ collision at energies near the Coulomb barrier. The long-time motion of the compound nuclear system is identified in terms of its classical quasiperiodic and chaotic behavior. The consequences of this motion are discussed and interpreted in terms of the evolution of the system along a dynamical energy surface. 21 references.

50835 (INIS-mf—9064, pp 12) **Shell-model description of narrow, highly-excited states in ${}^{9}Be$.** Woods, C.L.; Barker, F.C. (Australian National Univ., Canberra. Research School of Physical Sciences). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50836 (INIS-mf—9064, pp 37) **Analytic distorted wave approximation for intermediate energy pion and proton inelastic scattering.** Di Marzio, F.; Amos, K. (Melbourne Univ., Parkville (Australia). School of Physics). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50837 (INIS-mf—9064, pp 81) **E1 decay of the first excited state of ${}^{9}Be$.** Barker, F.C. (Australian National Univ., Canberra. Research School of Physical Sciences). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50838 (INIS-mf—9064, pp 24) **Measurements of angular distributions for the ${}^{6}Li(n,t){}^{4}He$ reaction in the MeV region.** Bartle, C.M. (Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Inst. of Nuclear Sciences). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50839 (INIS-mf—9064, pp 30) **Interaction of ${}^{7}Li$ with ${}^{16}O$ at 50 MeV.** Drumm, P.V.; Fifield, L.K.; Hotchkis, M.A.S.; Ophel, T.R.; Weisser, D.C.; Woods, C.L. (Australian National Univ., Canberra. Research School of Physical Sciences). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50840 (INIS-mf—9064, pp 39) **Photoneutron cross section for ${}^{12}C$, ${}^{14}N$ and ${}^{16}O$.** Facci, M.; Thompson, M.N. (Melbourne Univ., Parkville (Australia). School of Physics). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50841 (INIS-mf—9064, pp 54) **Coulomb excitation of the nucleus ${}^{7}Li$.** Vermeer, W.J.; Spear, R.H.; Esat, M.T.; Fewell, M.P. (Australian National Univ., Canberra. Research School of Physical Sciences); Baxter, A.M.; Hinds, S.; Burnett, S.M. (Australian National Univ., Canberra. Dept. of Physics). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50842 (INIS-mf—9064, pp 68) **Location of 3p-3h strength in ^{16}N via the reaction ^{13}C(α,p)^{16}N at 118 MeV.** Andrews, P.R.; Spicer, B.M.; Shute, G.G. (Melbourne Univ., Parkville (Australia). School of Physics) . 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50843 (INIS-mf—9064, pp 73) **^{17}O(γ,p) cross section.** Zubanov, D.; Thompson, M.N. (Melbourne Univ., Parkville (Australia). School of Physics); Berman, B.L. (Lawrence Livermore National Lab., CA (USA)); Pywell, R.E. (Saskatchewan Univ., Saskatoon (Canada). Dept. of Physics); Jury, J.W. (Trent Univ., Peterborough, Ontario (Canada). Dept. of Physics); McNeill, K.G. (Toronto Univ., Ontario (Canada). Dept. of Physics). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50844 (NEANDC(J)—95-U) **Evaluation of neutron nuclear data for ^{12}C.** Shibata, K. (Nuclear Energy Agency, 75 - Paris (France)). Dec 1983. 69p. (INDC(JAP)—82-L; JAERI-M—83-221). NTIS (US Sales Only), PC A04/MF A01. File Number DE84900731.

Neutron nuclear data of ^{12}C have been evaluated for JENDL-3 in the energy range from 10^{-5} eV to 20 MeV. Evaluated quantities are the total, elastic and inelastic scattering, radiative capture, photon-production, (n,p), (n,d) and (n,α) reaction cross sections and the angular or energy distribution of neutrons and photons. The total cross section below the threshold energy of the inelastic scattering has been calculated on the basis of the R-matrix theory. Three discrete levels have been taken into account for the inelastic scattering.

50845 (NEANDC(J)—104/U) **Neutron nuclear data of ^{7}Li adopted in JENDL-2.** Shibata, Keiichi. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Aug 1984. 39p. (INDC(JPN)—90/L; JAERI-M—84-163). Information Section, Div. of Technical Information, Japan Atomic Energy Research Inst., Tokai-Mura, Naka-gun, Ibaraki-ken 319-11, Japan. File Number TI84901850.

Neutron nuclear data of ^{7}Li were evaluated for JENDL-2 in the energy range from 10^{-5} eV to 20 MeV. Evaluated quantities are the total, elastic and inelastic scattering, (n,γ), (n,n')αt reaction cross sections and the angular distributions of neutrons. The present evaluation was completely based on available experimental data. 30 references.

50846 (NEANDC(J)—105/U) **Neutron nuclear data of ^{9}Be adopted in JENDL-2.** Shibata, Keiichi; Ioki, Kimihoro. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Sep 1984. 41p. (JAERI-M—84-165; INDC(JPN)—91/L). Information Section, Div. of Technical Information, Japan Atomic Energy Research Inst., Tokai-mura, Naka-gun, Ibaraki-ken 319-11, Japan. File Number TI84901864.

Neutron nuclear data of ^{9}Be were evaluated for JENDL-2 in the energy range from 10^{-5} eV to 20 MeV. Evaluated quantities are the total, elastic scattering, (n,2n), (n,γ), (n,p), (n,d), (n,t) and (n,α) reaction cross sections and the angular and energy distributions of emitted neutrons. The present evaluation was completely based on available experimental data. 40 references.

50847 **Excitation of giant resonances in pion inelastic scattering.** Morris, C.L. (Los Alamos National Laboratory, NM (USA)); Seestrom-Morris, S.J. (University of Minnesota, Minneapolis (USA)); Bland, L.C. (University of Pennsylvania, Philadelphia (USA)). *Journal de Physique (Paris), Colloque;* **45**: 327-336(Mar 1984). (CONF-830970—).

From International symposium on highly excited states and nuclear structure; Orsay, France (5 Sep 1983).

We present some recently obtained data for resonance energy inelastic pion scattering to the giant resonance region of nuclei. New results include the observation of candidates for spin-dipole resonances in ^{12}C and ^{28}Si, and the observation of large π+,π- cross section asymmetries for the continuum region in ^{208}Pb.

6514 Nuclear Properties And Reactions, A=20-38

50848 (CONF-840146—2) **Near-threshold production of neutral π mesons in heavy-ion reactions.** Young, G.R. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 19p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000985.

From 7. Oaxtepec meeting on nuclear physics; Oaxtepec, Mexico (3 Jan 1984).

Energy and angular distributions of neutral π mesons emitted in reactions of 35-MeV/u ^{14}N + Al, Ni, and W have been measured by using beams from the MSU K = 500 cyclotron. The measurements continue a long tradition of subthreshold (in the nucleon-nucleon sense) production of π mesons, extending back to the first artificial production by Gardner and Lattes using 75-MeV/u α-particle beams from the UCRL 184" synchrocyclotron. Comparisons are made with theory, ascribing the present production to mechanisms of varying degree of collectivity, and some suggestions are made concerning future experimental work. 34 references.

50849 (INIS-mf—9064, pp 19) **Coupled channels description of resonant structures in the ^{16}O + ^{20}Ne system.** Kondo, Y.; Robson, B.A.; Smith, R. (Australian National Univ., Canberra. Research School of Physical Sciences). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50850 (INIS-mf—9064, pp 32) **Resonant structures in the ^{20}Ne(^{16}O,^{12}C)^{24}Mg reaction.** Kondo, Y.; Robson, B.A.; Smith, R. (Australian National Univ., Canberra. Research School of Physical Sciences). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50851 (INIS-mf—9064, pp 22) **Masses and level schemes of very neutron-rich nuclei with A approximately 30.** Fifield, L.K.; Drumm, P.V.; Hotchkis, M.A.C.; Ophel, T.R.; Weisser, D.C.; Woods, C.L. (Australian National Univ., Canberra. Research School of Physical Sciences). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50852 (INIS-mf—9064, pp 59) **Parity-dependence of the nucleus-nucleus potential and ^{16}O + ^{24}Mg elastic scattering at theta sub(c.m.)=90°.** Kondo, Y.; Robson, B.A.; Smith, R.; Nurzynski, J.; Drumm, P.V.; Ophel, T.R.; Hebbard, D.F. (Australian National Univ., Canberra. Research School of Physical Sciences). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50853 (INIS-mf—9064, pp 60) **Proton induced reactions on ^{37}Cl and their relevance to nucleosynthesis.** Weber, R.O.; Mitchell, L.W.; Sevior, M.E.; Tingwell, C.I.W.; Sargood, D.G. (Melbourne Univ., Parkville (Australia). School of Physics). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50854 (INIS-SU—247, pp 81-86) **Use of total shadow profiles for obtaining the information on compounds nuclei lifetime.** Eremin, N.V.; Melikov, Yu.V.; Strizhov, V.F.; Tulinov, A.F. 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. File Number TI84780555. (CONF-8205270—).

From 12. All-Union conference on physics of interaction between charged particles and crystals; Moscow, USSR (25 May 1982).

A method to determine the shift based on comparison of complete shadow profiles with profiles calculated in the framework of a multistring model with respect to multiple scattering, is described. The determination of the shift value by comparing experimental shadow profile with theoretical curves is performed with the "DELHI" programme using the ES-1040 computer. To test the method, "differential" shadow profiles for α-particles from ^{27}Al(p, α) reaction at the resonance proton energy of 633 keV are used. Appropriate theoretical shadow profiles are calculated in the framework of the model of multistring potential. Account of multiple scattering of α-particles during their motion in the crystal is performed using the Fokker-Plank equation. The comparison of shift values obtained by the above and conventional method prove the adequacy of their mean values and a somewhat higher statistical accuracy of the shift value obtained on the basis of complete shadow profiles. The above technique sets higher requirements to theoretical models describing processes of passing of charged particles - reaction products - through a monocrystal.

50855 (INIS-SU—247, pp 87-89) **Influence of orientation of compound nuclei displacement in diametrical plane on axial shadow shape.** Eremin, N.V.; Melikov, Yu.V.; Strizhov, V.F.; Tulinov, A.F.; Yuminov, O.A. 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. File Number TI84780555. (CONF-8205270—).

From 12. All-Union conference on physics of interaction between charged particles and crystals; Moscow, USSR (25 May 1982).

Axial shadows <110> for α-particles from the ^{27}Al (p, α) reaction at the resonance proton energy of 1002 keV, are investigated with the aim of experimental proof of the shadow shape dependence on orientation of shift vector in the transverse channel plane. On the basis of a multistring model shadow profiles <110> are calculated for two different orientations in the range of alteration of the Usub(perpendicular) tau value (shift in the transverse channel plane) from 0 to 2.0 A. Multiple scattering is accounted using the Fokker-Plank equation. The comparison of experimental and calculation values of shadow profiles <100> for two different orientations proves the fact of existence of orientation dependence of the shadow shape.

50856 (UM-P—83/78) **Analyses of electron and proton scattering to low excitation isoscalar states in ^{20}Ne, ^{24}Mg and ^{28}Si.** Amos, K.; Bauhoff, W. (Melbourne Univ., Parkville (Australia). School of Physics). 1983. 42p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84703119.

Intermediate energy inelastic proton scattering differential cross section and polarization data from the 2_1^+ states in ^{24}Mg and ^{28}Si and from the 4_1^+ states in ^{28}Si have been analysed using the Distorted Wave Approximation with large basis models of nuclear structure. These structure models were tested by use in analyses of the longitudinal form factors obtained from inelastic electron scattering, so that analyses of the intermediate energy (p,p') data from the same transitions are then sensitive tests of the two-nucleon t-matrix. Data from these and other 2_1^+ transitions in ^{12}C and ^{20}Ne at 49 MeV (24 MeV in the case of ^{20}Ne), were also analysed to compare models of t-matrices at lower energies. An ancilliary study of the momentum transfer dependence of effective charges has been made as both s-d shell and large basis structure models have been used to compare with form factor data up to momentum transfers of 2.5 fm^{-1}. The deduced momentum dependence of the effective charges is significant.

6515 Nuclear Properties And Reactions, A=39-58

REFER ALSO TO CITATION(S) 65151050866, 50879

50857 (INIS-mf—9064, pp 71) **Direct reaction analysis of heavy ion collision from the quasi-elastic to the deep-inelastic regime.** Lenske, H.; Landowne, S.; Wolter, H.H. (Muenchen Univ. (Germany, F.R.). Sektion Physik); Tamura, T.; Udagawa, T. (Texas Univ., Austin (USA). Dept. of Physics). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50858 (INIS-mf—9064, pp 14) **Alpha particle induced reactions on ^{42}Ca and the mass 45 bottleneck.** Mitchell, L.W.; Sevior, M.E.; Tingwell, C.I.W.; Sargood, D.G. (Australian National Univ., Canberra. Research School of Physical Sciences). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50859 (INIS-mf—9064, pp 33) **^{58}Ni(p,γ)^{59}Cu cross section and its importance for nucleosynthesis and statistical model studies.** Tingwell, C.I.W.; Mitchell, L.W.; Sevior, M.E.; Sargood, D.G. (Melbourne Univ., Parkville (Australia). School of Physics). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50860 (INIS-mf—9064, pp 58) **Studies of very neutron-rich light nuclei using a gas target.** Hotchkiss, M.A.C.; Drumm, P.V.; Fifield, L.K.; Ophel, T.R.; Weisser, D.C.; Woods, C.L. (Australian National Univ., Canberra. Research School of Physical Sciences). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50861 (INIS-mf—9064, pp 64) **^{48}Ca(γ,n+p) photonuclear cross section in the giant dipole resonance region.** O'Keefe, G.J.; Assafiri, Y.I.; Thompson, M.N. (Melbourne Univ., Parkville (Australia). School of Physics). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50862 (INIS-mf—9064, pp 69) **^{40}Ca(p,pd)^{38}K and ^{40}Ca(p,2p)^{39}K reactions at 150 MeV.** Wastell, J.M.R.; Spicer, B.M.; Shute, G.G. (Melbourne Univ., Parkville (Australia). School of Physics) . 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50863 (INIS-mf—9064, pp 82) **^{48}Ca(d,^{3}He)^{47}K reaction at 80 MeV.** Banks, S.M.; Spice, B.M.; Shute, G.G. (Melbourne Univ., Parkville (Australia). School of Physics) . 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50864 (INIS-mf—9064, pp 88) **^{41}K(p,α)^{38}Ar cross section and its significance for nucleosynthesis.** Sevior, M.E.; Mitchell, L.W.; Tingwell, C.I.W.; Sargood, D.G. (Melbourne Univ., Parkville (Australia). School of Physics). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50865 **(KFK—3735) Dynamic density dependence of the alpha-nucleon force in folding models of inelastic scattering of alpha-particles.** Srivastava, D.K.; Rebel, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik). Apr 1984. 25p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84752161.

The importance of a dynamic density dependence of the α-particle-bound nucleon force is demonstrated by deformed folding model analyses of elastic and inelastic scattering of 104 MeV α-particles from ^{50}Ti and ^{52}Cr. Approximations are discussed and technical details are given.

6516 Nuclear Properties And Reactions, A=59-89

50866 (INIS-mf—9048, pp 65-73) **Systematics of nuclear level densities. Chapter V.** Tielens, T.A.A. 14 Sep 1983. NTIS (US Sales Only), PC A05/MF A01. File Number TI84780564.

In Nuclear spectroscopy of ^{24}Na and ^{46}Sc by thermal neutron capture.

The level densities of the ^{24}Na, ^{46}Sc, $^{48\ 49\ 50}$Ti, ^{60}Co, $^{64\ 65}$Cu and ^{239}U nuclei recently investigated by means of thermal neutron capture are described with the Fermi gas theory. Experimentally observed pairing effects in the level density parameter for nuclei in the mass region A = 40-81 are explained theoretically.

50867 **(LBL—18316) Neutron deficient mass surface between the 1f/sub 7/2/ and 1g/sub 9/2/ shells: the masses of ^{77}Kr and ^{75}Kr.** Moltz, D.M.; Sullivan, J.D.; Tribble, R.E.; Gagliardi, C.A.; Toth, K.S.; Avigonne, F.T. III. (South Carolina Univ., Columbia (USA); Oak Ridge National Lab., TN (USA); Texas A and M Univ., College Station (USA). Cyclotron Inst.). Sep 1984. Contract AC03-76SF00098. 9p. (CONF-8409143—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000698.

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

The masses of ^{77}Kr and ^{75}Kr have been measured utilizing the ^{80,78}Kr(^{3}He,^{6}He) reactions at E3/sub He/ = 70 MeV. These new results have been integrated into the total scheme of mass measurements in the light rubidium and krypton isotopes commenced several years ago. Comparisons with several mass formulae have also been made. 16 references.

50868 **Description of fragmentation as a critical phenomenon in high energy p-nucleus collisions.** Hirsch, A.S.; Bujak, A.; Finn, J.E.; Gutay, L.J.; Minich, R.W.; Porile, N.T.; Scharenberg, R.P.; Stringfellow, B.C. (Purdue Univ., Lafayette, IN (USA). Dept. of Physics; Purdue Univ., Lafayette, IN (USA). Dept. of Chemistry); Turkot, F. (Fermi National Accelerator Lab., Batavia, IL (USA)). *Nuclear Physics [Section] A;* **418**: 267c-287c(23 Apr 1984). (CONF-8309168—).

From 3. international conference on ultra-relativistic nucleus-nucleus collisions; Upton, NY, USA (26 Sep 1983).

In an inclusive experiment, isotopically resolved fragments, 3<=Z<=13, produced in high-energy proton-nucleus collisions, have been studied using a low mass time-of-flight, gas delta E-silicon E spectrometer and the internal gas jet at Fermi National Accelerator Laboratory. Measurement of the kinetic energy spectra from 5 MeV to 100 MeV enabled on accurate determination of fragment cross sections from both xenon and krypton targets. The observed isobaric yield is given by Y α Asub(f)sup(-tau), where tauapprox.=2.6 for both targets. The power law is the signature of the fragment formation mechanism. We treat the formation of fragments as a liquid-gas phase transition at the critical point. The critical temperature Tsub(c) can be determined from the fragment isotopic yield provided one can set an energy scale for the fragment free energy. The high energy tails of the kinetic energy spectra provide evidence that the fragments originate from a common remnant system somewhat lighter than the target which disassembles simultaneously via Coulomb repulsion into a multibody final state. Fragment Coulomb energies are about 1/10 of the tangent sphere values. The remnant is characterized by a parameter T_0 obtained from the high energy tails of the kinetic energy distributions. T_0 is interpreted as reflecting the mean squared momentum of a nucleon in the remnant system.

6517 Nuclear Properties And Reactions, A=90-149

50869 **(DOE/ER/03346—257) Nuclear chemistry research and spectroscopy with radioactive sources. Twentieth annual progress report, September 1, 1983-August 31, 1984.** Fink, R.W. (Georgia Inst. of Tech., Atlanta (USA). School of Chemistry). 31 Aug 1984. Contract AS05-76ER03346. 43p. (ORO—3346-257). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85001336.

Research under this continuing DOE contract centers on radioactive decay studies of nuclei far from stability produced with heavy ions from the Holifield Heavy Ion Research Facility (HHIRF) and studied on-line with the University Isotope Separator at Oak Ridge (UNISOR). These investigations encompass three aspects of nuclear structure research: nuclear spectroscopic measurements involving detailed $\gamma\gamma t$, $\gamma e^- t$, and $X\gamma t$ three-parameter coincidence spectrometry; on-line laser hyperfine structure (hfs) and isotope shift spectroscopy for determining quadrupole moments, nuclear spins, and mean nuclear charge radii; and computer calculations of nuclear model predictions for comparison with the experimental level schemes. The focus of this research program is on odd-mass nuclei in which the odd nucleon probes the core, making possible observation of such phenomena as the onset of abrupt shape changes, the occurrence of shape coexistence, and shell-model intruder states. These phenomena are critical tests of concepts fundamental to an understanding of low-energy nuclear structure, such as nuclear deformations, shell models, collective models, and particle-core couplings.

50870 **(GSI—84-28(Prepr.)) Properties of heavy-ion produced nuclei far from stability.** Roeckl, E.; Schardt, D. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). May 1984. 8p. (CONF-840530—6). NTIS (US Sales Only), PC A02/MF A01. File Number DE84752168.

From International symposium on in-beam nuclear spectroscopy; Debrecen, Hungary (14 May 1984).

Nuclei far from stability are produced in reactions with heavy-ion beams between ^{16}O and ^{238}U from the UNILAC with energies between 4 and 12 MeV/u and investigated by using on-line mass separation. Recent results are presented from decay spectroscopy of neutron-rich isotopes, neutron-deficient isotopes around ^{100}Sn and ^{146}Gd and collinear laser spectroscopy of light indium and tin isotopes.

50871 (INIS-mf—9052, pp 1) **Collective states in transitional nuclei.** Bretano, P. von (Koeln Univ. (Germany, F.R.)). 1983. NTIS (US Sales Only), PC A99/MF A01. File Number TI84780548. (CONF-8309253—Absts.).

From 1. national congress of the physicists in Bulgaria; Sofia, Bulgaria (28 Sep 1983).

50872 (INIS-mf—9064, pp 20) **Heavy-ion physics - the future.** Newton, J.O. (Australian National Univ., Canberra. Research School of Physical Sciences). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50873 (INIS-mf—9064, pp 25) **Elastic scattering of γ-rays at small scattering angles.** Hicks, G.; Taylor, R.B.; Teansomprasong, P.; Whittingham, I.B. (James Cook Univ. of North Queensland, Townsville (Australia)). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50874 (INIS-mf—9064, pp 50) **Octupole-vibrational states in the even mass isotopes of barium.** Burnett, M.; Baxter, A.M.; Hinds, S.; Pribac, F. (Australian National Univ., Canberra. Dept. of Physics); Spear, R.H.; Vermeer, W.J. (Australian National Univ., Canberra. Research School of Physical Sciences). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50875 (INIS-mf—9064, pp 63) **Photoneutron reaction cross sections of ^{121}Sb, ^{123}Sb and Nat.Sb.** Rassool, R.P.; Orr, D.; Thompson, M.N. (Melbourne Univ., Parkville (Australia). School of Physics). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50876 (INIS-mf—9064, pp 48) **Neutron emission from accelerating fission fragments.** Hinde, D.J. (Australian National Univ., Canberra. Research School of Physical Sciences). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50877 (UM-P—83/79) **Photoneutron cross sections of ^{121}Sb, ^{123}Sb and sup(nat) Sb.** Rassool, R.P.; Orr, D.A.; Thompson, M.N. (Melbourne Univ., Parkville (Australia). School of Physics). Dec 1983. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703125.

The cross sections for the reactions ^{121}Sb (γ,n), ^{123}Sb(γ,xn) and sup(nat) Sb(γ,xn) have been measured. The ^{121}Sb and ^{123}Sb photoneutron reaction cross sections are consistent with collective model predictions for negatively deformed nuclei.

50878 **Dependence of the excitation energy, width, and cross section of the isovector monopole resonance.** Bowman, J.D.; Baer, H.W.; Cooper, M.D. (Los Alamos National Laboratory (U.S.A.)). *Journal de Physique (Paris), Colloque;* **45**: 351-355(Mar 1984). (CONF-830970—).

From International symposium on highly excited states and nuclear structure; Orsay, France (5 Sep 1983).

We have used the (π-,π^0) charge reaction at 165-MeV kinetic energy to study the T + 1 component of the isovector monopole resonance (IVM). The nuclei ^{40}Ca, ^{60}Ni, ^{90}Zr, ^{120}Sn, ^{140}Ce, and ^{208}Pb were used as targets. We also observed the T + 1 component of the giant dipole resonance (GDR) in the lighter targets. The (π+, π^0) reaction also yielded positive results for the T - 1 component of the IVM and GDR in ^{40}Ca, ^{60}Ni, and ^{90}Zr.

50879 **Excitation of giant resonances in pion charge-exchange reactions.** Auerbach, N. (Los Alamos National Laboratory, NM (U.S.A.); Tel-Aviv University (Israel)). *Journal de Physique (Paris), Colloque;* **45**: 305-318(Mar 1984). (CONF-830970—).

From International symposium on highly excited states and nuclear structure; Orsay, France (5 Sep 1983).

The theory for excitation of electric giant isovector resonances in pion charge-exchange reactions is discussed. A comparison between the theoretical and the recent experimental results is made.

50880 **Heavy ion excitation and photon decay of giant resonances.** Bertrand, F.E.; Beene, J.R.; Sjoreen, T.P. (Oak Ridge National Laboratory, TN (U.S.A.)). *Journal de Physique (Paris), Colloque;* **45**: 99-114(Mar 1984). (CONF-830970—).

From International symposium on highly excited states and nuclear structure; Orsay, France (5 Sep 1983).

Results are presented for excitation of giant multipole resonance by inelastic scattering of 350 and 400 MeV ^{16}O projectiles from ^{90}Zr and ^{208}Pb. The giant quadrupole resonance is excited with large cross sections and a very large resonance peak to continuum ratio is obtained. Extracted cross sections agree with DWBA calculations which use standard collective model form factors. Using 380 MeV ^{17}O to excite the giant resonances, the γ-ray decay has been measured for the giant quadrupole resonance region of ^{208}Pb.

50881 **Opposing properties of particle-hole and intruder-hole bands in N = 87 nuclei and ^{149}Sm levels populated by ^{149}Pm (β^-) and ^{149}Eu(EC).** Meyer, R.A.; Meadows, J.W.T.; Macias, E.S. (Lawrence Livermore National Lab., CA). *Journal of Physics G: Nuclear Physics;* **8**: No. 10, 1413-1429(Oct 1982).

Members of an hsub(9/2) band are identified by using known reaction data in conjunction with precise measurements of γ-ray and conversion electron properties on doubly-mass-separated ^{149}Eu and singly-mass-separated ^{149}Pm. Similar bands in N = 87 nuclei with nuclei with Z = 56-66 are shown to have properties consistent with the hsub(9/2) particle intruder bands in heavier odd-proton nuclei. When the properties of the N = 87 nuclei are compared, it is shown that, as expected, the particle fsub(7/2)sup(N) and hsub(9/2) bands have less collectivity and increase in energy as the Z = 64 subshell closure is approached. This trend is shown to be opposite to the decrease in energy of the known intruder ssub(1/2), dsub(3/2) and hsub(11/2) states. Such opposing trends can be accounted for if the properties of the underlying even-even nuclei are taken into account.

6518 Nuclear Properties And Reactions, A=150-189

REFER ALSO TO CITATION(S) 65181050871, 50892

50882 **(GSI—84-3) Studies of extremely neutron-deficient isotopes near the proton shell Z = 82.** Schneider, J. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Mar 1984. 119p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE84751927.

In the framework of this thesis the radioactive decay of extremely neutron-deficient isotopes in the environment of the closed proton shell Z = 82 was studied. By the selection of nearly symmetrical target-projectile combinations light compound systems with low excitation energies far from the valley of β stability could be produced. Altogether ten new isotopes of the elements Au, Hg, Tl, Pb, and Bi were identified. They all show half-lives smaller than 300 ms.

50883 (INIS-mf—9064, pp 15) **Neutron evaporation following heavy ion reactions for systems with 150 < A < 190.** Chatterjee, A.; Charity, R.J.; Hinde, D.J.; Foote, G.S.; Leigh, J.R.; Newton, J.O. (Australian National Univ., Canberra. Research School of Physical Sciences). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50884 (INIS-mf—9064, pp 18) **Measurement of the g-factors of high-spin states in ^{158}Er.** Ryan, C.G.; Bolotin, H.H. (Melbourne Univ., Parkville (Australia). School of Physics); Sie, S.H. (Australian National Univ., Canberra. Research School of Physical Sciences). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50885 (INIS-mf—9064, pp 34) **Inelastic scattering of intermediate energy protons from tungsten.** Lay, B. (Melbourne Univ., Parkville (Australia). School of Physics). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50886 (INIS-mf—9064, pp 53) **Long lifetimes and moments through the backbend in ^{168}W.** Dracoulis, G.D. (Australian National Univ., Canberra. Research School of Physical Sciences). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50887 (INIS-mf—9064, pp 61) **Localized I window from partial fusion reactions accompanied by proton, deuteron, and triton emission.** Yamada, H. (Melbourne Univ., Parkville (Australia). School of Physics). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50888 (INIS-mf—9064, pp 77) **Quadrupole moments of the 12^+ isomers in mercury 188 and mercury 190.** Dracoulis, G.D. (Australian National Univ., Canberra. Research School of Physical Sciences). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50889 (INIS-mf—9064, pp 80) **Variations of the gyromagnetic ratios of corresponding states in ^{188} ^{190} ^{192}Os - measurements and interpretations.** Stuchbery, A.E.; Bark, R. (Australian National Univ., Canberra. Dept. of Nuclear Physics); Bolotin, H.H.; Morrison, I.; Wood, L. (Melbourne Univ., Parkville (Australia). School of Physics). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50890 (INIS-mf—9064, pp 83) **Partial fusion reaction and its application to high-spin spectroscopy.** Yamada, H. (Melbourne Univ., Parkville (Australia). School of Physics). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50891 (INIS-mf—9064, pp 86) **Heavy ion induced fission reactions.** Charity, R.J. (Australian National Univ., Canberra. Research School of Physical Sciences). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50892 (INIS-SU—247, pp 56-70) **Fission lifetimes from blocking measurements: ^{19}F bombardment of a thin tantalum crystal.** Forster, J.S.; Mitchell, I.V.; Andersen, J.U.; Jensen, A.S.; Laegsgard, E.; Gibson, W.M.; Reichelt, K. 1983. NTIS (US Sales Only), PC A11/MF A01. File Number TI84780555. (CONF-8205270—).

From 12. All-Union conference on physics of interaction between charged particles and crystals; Moscow, USSR (25 May 1982).

The blocking method is used to measure the lifetime of a compound lead nucleus obtained by the bombardment of a thin tantalum crystal with 92.5-120 MeV ^{19}F ions. When calculating the blocking angle, Lindhard standard nuclear potential is used. In the course of experiment, angular distribution of decay products and the decay total cross section is measured. Results obtained by the above technique are compared with statistical model calculations. It is noted that the combination of the above technique with the statistical model helps to reduce inambiguities compared to using the statistical model alone.

50893 (UCRL—91091) **Isomer ratio calculations using modeled discrete levels.** Gardner, M.A.; Gardner, D.G.; Hoff, R.W. (Lawrence Livermore National Lab., CA (USA)). 29 Aug 1984. Contract W-7405-ENG-48. 6p. (CONF-840906—5). NTIS, PC A02/MF A01; GPO Dep. File Number DE85001743.

From Capture gamma-ray spectroscopy conference; Knoxville, TN, USA (10 Sep 1984).

We have calculated isomer ratios for the ^{175}Lu(n,γ), ^{175}Lu(n,2n), ^{237}Np(n,2n), ^{241}Am(n,γ), and ^{243}Am(n,γ) reactions using modeled level structures in the deformed, odd-odd product nuclei. We find: that the hundreds of discrete levels and their gamma-ray branching ratios provided by the modeling are necessary to achieve agreement with experiment, that many rotational bands must be included in order to obtain a sufficiently representative selection of K quantum numbers, and that the levels of each band must be extended to appropriately high values of angular momentum. 8 references.

50894 (UCRL—91098) **Absolute dipole gamma-ray strength functions for ^{176}Lu.** Gardner, D.G.; Gardner, M.A.; Hoff, R.W. (Lawrence Livermore National Lab., CA (USA)). 29 Aug 1984. Contract W-7405-ENG-48. 6p. (CONF-840906—4). NTIS, PC A02/MF A01; GPO Dep. File Number DE85001746.

From Capture gamma-ray spectroscopy conference; Knoxville, TN, USA (10 Sep 1984).

We have derived absolute dipole strength-function information for ^{176}Lu from an average resonance capture study of ^{175}Lu with 2-keV neutrons, and from neutron capture cross-section measurements with neutrons from 30 keV to about 1 MeV. We found that we needed to increase our previous estimate of the relative M1/E1 strengths near 5 MeV by a factor of 3, and to revise downward the absolute magnitude of our E1 strength function. We accomplished the latter, while still maintaining continuity with the photonuclear data, by adjusting the one free parameter in our line shape. The present E1 and M1 strengths now seem correct both near the neutron separation energy and also around 1 MeV.

50895 **Intrinsic excitations in deformed nuclei. Characteristic predictions of the IBA.** Casten, R.F. (Brookhaven National Lab., Upton, NY (USA)). pp 431-442 of Proceedings of 1982 INS international symposium on dynamics of nuclear collective motion, at the foot of Mt. Fuji. High spin states and transitional nuclei. Ogawa, K.; Tanabe, K. (eds.). Tokyo, Japan; Tokyo Univ., Inst. for Nuclear Study (1982). (CONF-820738—).

From INS symposium on dynamics of nuclear collective motion; Mount Fuji, Japan (6 Jul 1982).

The intrinsic excitation in deformed nuclei was studied. A review of the properties of (n, γ) reaction is described. Descriptions of the results of Er-168 study and the application of the Interacting Boson Approximation (IBA) model to the resultant level scheme are presented. The IBA model can be applied to deformed nuclei by recognizing that such nuclei are reasonably close to the SU(3) limit of that model. An extremely simplified Hamiltonian can be written for deformed nuclei when the β band is above the γ band. To treat deformed nuclei realistically SU(3) symmetry breaking must be introduced. The calculated energy of K = 0 and 2 bands was compared with the data. The agreement was excellent. The results of absolute B(E2) values and branching ratio were rather good, but some discrepancy was seen. The most interesting IBA prediction was that of collective β to γ transition. The discussion was generalized to other deformed nuclei, and to the inherent systematic prediction that must characterize the IBA for such nuclei. Many of these ideas will be related to the role of finite boson number in the IBA.

50896 **Properties of quasi neutron configurations in 165FYb at very large angular frequencies. Interpretation in terms of gradual neutron pairing decrease.** Schueck, C.; Benjaballah, N.; Diamond, R.M.; Ellis-Akovali, Y.; Lindenberger, H. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). pp 474-478 of Proceedings of 1982 INS international symposium on dynamics of nuclear collective motion, at the foot of Mt. Fuji. High spin states and transitional nuclei. Ogawa, K.; Tanabe, K. (eds.). Tokyo, Japan; Tokyo Univ., Inst. for Nuclear Study (1982). (CONF-820738—).

From INS symposium on dynamics of nuclear collective motion; Mount Fuji, Japan (6 Jul 1982).

The new experimental data of Yb-165 up to very high angular frequency are presented and discussed. Two experiments were performed at the Cyclotron Facility in the Lawrence Berkeley Laboratory. Heavy ion beams (Ar-40 and Ne-20) were used for the production of Yb-165. The experimental values of the component of the total angular momentum along the rotation axis versus frequency for Yb-165 and the neighbouring nuclei indicated that the component decreased faster with increasing frequency relative to the even-even isotopes. The decay information has been expressed as routhians in the rotating frame versus the angular frequency. These values refer to the average of similar values for the yrast sequence in the even-even neighbouring nuclei. It was found that for frequency above 0.38 MeV, all three quasi-neutron states started to dealign. A gradual neutron pairing decrease with increasing rotational frequency predicted by Mettelson and Valatin and by Tanabe and Sugawara-Tanabe was the suggested cause of this effect, even though a shape change was not able to be experimentally excluded.

6519 Nuclear Properties And Reactions, A=190-219

50897 **(HMI-P—27/83-HF(Prepr.)) In-beam alpha, electron, and gamma-ray spectroscopy of ^{215}Fr.** Decman, D.J.; Grawe, H.; Kluge, H.; Maier, K.H.; Maj, A.; Menningen, M.; Roy, N.; Wiegner, W. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (Germany, F.R.). Bereich Kern- und Strahlenphysik). 1983. 51p. NTIS (US Sales Only), PC A04/MF A01. File Number DE84751507.

The nucleus ^{215}Fr was studied using the ^{208}Pb(^{11}B, 4n) and ^{204}Hg(^{15}N, 4n) reactions. The measurements included α-γ, γ-γ, and e-e coincidence experiments as well as γ-ray and α-particle DPAD studies. The decay scheme gives levels up to a 3068 keV 39/2$^-$ isomer with tsub(1/2)=(33 +- 5) ns as well as 3 shorter-lived isomers (tsub(1/2) approx.= 4 ns); g-factors have been measured for these isomers. The alpha-particle spectroscopy showed the existence of 4 longrange alphas which could be assigned to excited states in ^{215}Fr. tsub(1/2)(^{215}Frsup(gs)) = (86+-5) ns has been remeasured. The negative parity states up to 1680 keV seem to be members of the π(h9/2)^{5}9/2sup(ν)(g9/2)^2 configuration; a strong hindrance of M1 transitions is found. The higher lying states are compared with the DIPM model.

50898 (INIS-mf—9052, pp 19) **Exponentially decreasing newtonian force in the place of Yukawa potential.** Karastoyanov, A. (Vissh Massinno-Elektrotekhnicheski Inst., Sofia (Bulgaria)). 1983. (In Bulgarian). NTIS (US Sales Only), PC A99/MF A01. File Number TI84780548. (CONF-8309253—Absts.).

From 1. national congress of the physicists in Bulgaria; Sofia, Bulgaria (28 Sep 1983).

50899 (INIS-mf—9064, pp 13) **Yrast states and isomers in ^{205}At.** Davies, R.F.; Poletti, A.R. (Auckland Univ. (New Zealand). Dept. of Physics); Dracoulis, G.D.; Byrne, A.P.; Fahlander, C. (Australian National Univ., Canberra. Research School of Physical Sciences). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50900 (INIS-mf—9064, pp 28) **Alignment of neutrons and protons in rotating ^{190} ^{192} ^{194}Hg nuclei.** Byrne, A.P.; Dracoulis, G.D.; Hubel, H.; Ogaza, S. (Australian National Univ., Canberra. Research School of Physical Sciences). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50901 (INIS-mf—9064, pp 56) **High spin states in Fr nuclei.** Byrne, A.P.; Dracoulis, G.D. (Australian National Univ., Canberra. Research School of Physical Sciences); Hubel, H. (Bonn Univ. (Germany, F.R.)); Davie, R.F. (Auckland Univ. (New Zealand). Dept. of Physics). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50902 **(LA-UR—84-2767) Analysis of n + ^{197}Au cross sections for E/sub n/ = 0.01-20 MeV.** Young, P.G.; Arthur, E.D. (Los Alamos National Lab., NM (USA)). 9 Sep 1984. Contract W-7405-ENG-36. 5p. (CONF-840906—6). NTIS, PC A02/MF A01; GPO Dep. File Number DE85002013.

From Capture gamma-ray spectroscopy conference; Knoxville, TN, USA (10 Sep 1984).

An analysis of n + ^{197}Au reactions has been completed for incident neutron energies between 0.01 and 20 MeV. The analysis involves use of a deformed optical model to calculate neutron transmission coefficients, a giant-dipole-resonance model and experimental data to determine gamma-ray transmission coefficients, and Hauser-Feshbach statistical theory to calculate partial reaction cross sections. Particular emphasis was given to obtaining gamma-ray strength functions that are consistent with spectral measurements of gamma-ray emission between E/sub n/ = 0.2 and 20 MeV by Morgan and Newman, while at the same time requiring agreement with (n,γ) and (n,xn) cross-section data. 16 references.

50903 **(UM-P—83/58) Bose-fermi U(6/2j+1) supersymmetries and high spin anomalies.** Morrison, I.; Jarvis, P.D. (Melbourne Univ., Parkville (Australia). School of Physics). Jul 1983. 24p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703115.

A supersymmetric extension of the Interaction Boson Model is constructed to describe high spin anomalies in both even- and odd-mass spectra of the Hg,Pt region (190 <= A <= 200). Supergroup chains incorporate a single j-shell fermion in addition to the usual s and d bosons (L=0 and L=2). The orthosymplectic supergroup reflects the strong pairing force in the subspace of the fermion intruder level. The model agrees favourably with experiment and microscopic calculation.

6520 Nuclear Properties And Reactions, A=220 And Above

REFER ALSO TO CITATION(S) 65201050893

50904 (INIS-mf—9064, pp 21) **Measurement of subthreshold fission cross section in ^{230}Th(n,f).** Walsh, R.L.; Boldeman, J.W. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50905 **(LA-UR—84-3022) Calculated masses and half-lives for nuclei in the region 100 ≦ Z ≦ 110.** Leander, G.A.; Moeller, P.; Nix, J.R.; Howard, W.M. (Oak Ridge Associated Universities, Inc., TN (USA); Lawrence Berkeley Lab., CA (USA); Los Alamos National Lab., NM (USA); Lawrence Livermore National Lab., CA (USA)). 1984. Contract AC03-76SF00098;W-7405-ENG-36. 8p. (CONF-8409143—1; LBL—18307). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002046.

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

We have calculated nuclear masses and the corresponding α-decay energies O/sub α/ and α half-lives T/sub α/ by use of the folded-Yukawa macroscopic-microscopic model, for nuclei at the end of the peninsula of known elements. We have also calculated, by use of the modified oscillator model, fission half-lives for even-even nuclei with Z between 100 and 110. The results agree well with data in this region, but an interpretation of the experimental data required further and extensive theoretical studies of odd particle effects. 13 references.

6530 Nuclear Theory

50906 (INIS-mf—9064, pp 35) **Parity admixtures in the nucleon wavefunction.** McKellar, B.H.J. (Melbourne Univ., Parkville (Australia). School of Physics). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50907 (INIS-mf—9064, pp 65) **Particle-hole description of the nuclear giant dipole resonance in light-to-medium nuclei.** Assafiri, Y.I.; Morrison, I. (Melbourne Univ., Parkville (Australia). School of Physics). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50908 (INIS-mf—9064, pp 27) **Relativistic corrections to the theory of Coulomb excitation.** Fewell, M.P. (Australian National Univ., Canberra. Research School of Physical Sciences). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50909 (INIS-mf—9064, pp 45) **Unitarity and K-matrix model fitting.** Pearce, B.C. (Flinders Univ. of South Australia, Bedford Park. School of Physical Sciences). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50910 (INIS-mf—9064, pp 62) **Spin dependent effects in pion-nucleus scattering.** Berge, L. (Melbourne Univ., Parkville (Australia). School of Physics). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50911 (INIS-mf—9064, pp 74) **Medium corrections in inelastic proton scattering at intermediate energies.** Bauhoff, W. (Melbourne Univ., Parkville (Australia). School of Physics). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number TI84780621. (CONF-840216—).

From 10. nuclear physics conference; Canberra, Australia (6 Feb 1984).

50912 (INIS-SU—216, pp 158-193) **Capture of pions by nuclei.** Sergeev, F.M. 1982. (In Russian). NTIS (US Sales Only), PC A10/MF A01. File Number TI84780550.

In Elementary particle physics. Proceedings of 17. Winter school of Leningrad Institute of Nuclear Physics.

A rewiew of the basic experimental data relating to pion absorption by atomic nuclei is given. Primary emphasis is paid to the isolation of the direct pion absorption process by the group of nuclear nucleons and also to the investigation of matrix element components of the direct process. Data on energy spectra, angular distributions and angular correlations of secondary particles are presented. An importance of absorption reactions for effective study of light nuclei and nucleon resonances is noted.

50913 **(KFKI—1983-128) Hydrodynamical description of the quark-gluon plasma formation in heavy-ion collisions at intermediate energies.** Barz, H.W.; Kaempfer, B.; Csernai, L.P.; Lukacs, B. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Dec 1983. 6p. (CONF-8310265—5). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703116.

From International symposium on the theory of elementary particles; Ahrenshoop, German D.R. (9 Oct 1983).

The Rankine-Hugoniot-Taub equations for the formation of a quark gluon plasma in a stationary process is considered, and the need of a proper dynamical description is emphasized. Results are presented concerning the hydrodynamical description of a head-on collision of heavy ions at intermediate bombarding energies. The transition to quarks and vice versa is treated in terms of a non-equilibrium phase transition. For bombarding energies above 5 GeV/nucleon, a total conversion into quark matter is possible while for bombarding energies between 3 and 5 GeV/nucleon, there is only a partial conversion depending strongly on the conversion rate.

50914 **(KFKI—1983-131) Volume corrections for the specific entropy in nucleon-deuteron mixtures.** Lukacs, B. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Dec 1983. 6p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703117.

Some estimations are made for the influence of the deuteron volume on the d/p ratio in dilute, hot deutèron-nucleon gases. The result is that in reasonable equations of state, this volume can imitate an 'entropy excess' similar to that in 0.4-0.8 GeV/nucleon heavy ion collisions, so it is possible that there is no excess at all.

50915 **(LA-UR—84-2938) Medium energy probes and the IBM.** Ginocchio, J.N. (Los Alamos National Lab., NM (USA)). 4 Sep 1984. Contract W-7405-ENG-36. 22p. (CONF-8405231—8). NTIS, PC A02/MF A01; GPO Dep. File Number DE85002040.

From International workshop on interacting boson-boson and boson-fermion systems; Gull Lake, MI, USA (28 May 1984).

Medium energy scattering theory and the interacting boson model of nuclei (IBM) are combined so that the multiple scattering to intermediate IBM states is summed to all orders. 16 references.

50916 **(LA-UR—84-3023) Contributions of pair correlations to pion-nucleus double charge exchange.** Liu, L.C. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 3p. (CONF-8410144—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85000938.

From International symposium on nuclear shell model; Philadelphia, PA, USA (31 Oct 1984).

Recognizing the importance of both the reaction mechanism and nuclear structure aspects of the DCX, a new reaction theory was proposed in 1981 which offers a consistent treatment of these two equally important components of pion DCX. In this theory, the density square-dependent interaction is derived from the dynamical consideration of true pion absorption on a nucleon pair inside the nucleus. The strength of this new pion-nucleus interaction can then be calculated from the knowledge of the second-order pion-nucleus optical potential. With no free parameters for the pion-nucleus interaction and with the use of the coexistence nuclear model, the theory gives satisfactory descriptions of the magnitude and the shape of 5° excitation functions as well as of the differential

cross sections for the DCX reactions $^{18}O(\pi^+,\pi^-)$ ^{18}Ne(DIAS) and $^{42}Ca(\pi^+,\pi^-)$ ^{42}Ti(DIAS) between 120 and 290 MeV. Our basic conclusions are: (1) the TSSCX mechanism alone cannot describe pion DCX; (2) the position of the first minimum in the differential cross section is very sensitive to the inclusion of density square-dependent interaction; and (3) on the other hand, the magnitude of the cross section is very sensitive to the inclusion of pair correlations (core excitation in the case with ^{18}O and ^{42}Ca).

50917 **(UM-P--84/3) Comment on '(p,n) and (n,p) reactions as probes of isovector giant monopole resonances'.** Bauhoff, W. (Melbourne Univ., Parkville (Australia). School of Physics). 1984. 7p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703120.

The importance of medium corrections in the excitation of the isovector giant monopole resonance by nucleons is investigated. A large reduction of the cross-section, compared to calculations with free t-matrices, is found at projectile energies around 100 MeV. This will make observation of the isovector monopole at these energies even more difficult than estimated by Auerbach et al.

50918 **Accelerating beta decay rates.** Lyon, W.S. (Oak Ridge National Lab., TN). *Journal of Radioanalytical and Nuclear Chemistry;* **86**: No. 4, 205-208(15 Jun 1984).

It has been believed recently that beta decay rates can be speeded up by intense external field of electromagnetic radiation or in the focus of a very intense laser beam. The theoretical discussions and experimental efforts are under way. The importance of the idea of the mutability of half-lives through external means is stressed. Practical applications, e.g. waste disposal and improving low level counting statistics are suggested. 7 references.

50919 **New statistical and nonstatistical effects in deep inelastic heavy-ion collision.** Moretto, L.G. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.); Lawrence Berkeley Lab., CA (USA)). *Nuovo Cimento* [*Sezione*] *A;* **81**: No. 1, 21-36(1 May 1984). Contract AC03-76SF00098.

The physics of deep inelastic heavy-ion collisions is briefly reviewed in the light of the experimental capabilities offered by large tandem accelerators. Three aspects are selected for illustration. The first is the problem posed by the angular distributions. The role of quantal fluctuations (diffraction) and of dynamical fluctuations is discussed. The possibility of extracting angular-momentum fluctuations from the angular-distribution width is pointed out, as well as the way to compare such results with those obtained from gamma-ray multiplicities of angular distributions. The likely sources of angular-momentum fluctuations are discussed. The second problem is that of energy dissipation and partition. The experimental evidence for thermal equilibrium is reviewed and experiments to test thermal equilibrium through the measurement of the variance in the energy distribution are suggested. The correlation between energy loss and the mass variance is reviewed in terms of the mass transfer mechanism. Possible ways to determine the mass of the transferred particle are illustrated. The third problem considered is the experimental lack of mass drift in the mass distributions vs. Q-value when it is expected on the basis of potential-energy considerations. This problem is associated with the fast-fragment thermalization and explained in terms of a feedback effect associated with the temperature gradient that develops between two colliding nuclei of different mass.

50920 **Collective, stochastic and nonequilibrium behavior of highly excited hadronic matter.** Carruthers, P. (Los Alamos National Lab., NM (USA). Theoretical Div.). *Nuclear Physics* [*Section*] *A;* **418**: 501c-523c(23 Apr 1984). (CONF-8309168—).

From 3. international conference on ultra-relativistic nucleus-nucleus collisions; Upton, NY, USA (26 Sep 1983).

Also published as report LA-UR--83-3067 .

We discuss selected problems concerning the dynamics and stochastic behavior of highly excited matter, particularly the QCD plasma. For the latter we consider the equation of state, kinetics, quasiparticles, flow properties and possible chaos and turbulence. The promise of phase space distribution functions for covariant transport and kinetic theory is stressed. The possibility and implications of a stochastic bag are spelled out. A simplified space-time model of hadronic collisions is pursued, with applications to A-A collisions and other matters. The domain wall between hadronic and plasma phase is of potential importance: its thickness and relation to surface tension is noticed. Finally, we review the recently developed stochastic cell model of multiparticle distributions and KNO scaling. This topic leads to the notion that fractional dimensions are involved in a rather general dynamical context. We speculate that various scaling phenomena are independent of the full dynamical structure, depending only on a general stochastic framework having to do with simple maps and strange attractors. 42 refs.

50921 **Signatures of new phenomena in ultrarelativistic nuclear collisions.** Gyulassy, M. (Lawrence Berkeley Lab., CA (USA)). *Nuclear Physics* [*Section*] *A;* **418**: 59c-85c(23 Apr 1984). (CONF-8309168—). Contract AC03-76SF00098.

From 3. international conference on ultra-relativistic nucleus-nucleus collisions; Upton, NY, USA (26 Sep 1983).

Also published as report LBL--16800 .

Three classes of observables are discussed which may shed light on the properties of the quark-gluon plasma formed in ultrarelativistic nuclear collisions. They are (1) thermometers: the penetrating probes $\mu^+\mu^-$, γ, c, (2) barometers: transverse flow via <psub(perpendicular to)>, and (3) seismometers: fluctuations of dN/dy and dEsub(perpendicular to)/dy. The need for reliable estimates of the background due to the non-equilibrium processes is emphasized. 49 refs.

50922 **Pauli-corrected Breit-Wigner formulae for compounds resonances in two- and three-cluster systems.** Orlowski, M. (Stanford Linear Accelerator Center, CA (USA)). *Nuovo Cimento* [*Sezione*] *A;* **80**: No. 1, 89-110(1 Mar 1984).

Breit-Wigner formulae for compound resonances in two- and three-cluster systems are derived. Analytic corrections due to the Pauli principle with regard to corresponding formulae for partial resonance widths and resonance pole shifts are given. In the case of a system of three composite particles a model is formulated in which sudden decay into three clusters is determined by the knowledge of the microscopical compound state of the metastable decaying nucleus. The derivation of the Breit-Wigner formulae in the case of a three-cluster system is based on the study of the asymptotic behavior of the full three-body Green's function. In the case of the two-body channel situation the formalism presented here is a modification of the Widdermuth-Benoehr reaction theory.

50923 **Oscillatory structure of the harmonic oscillator Wigner function.** Rowley, N.; Prakash, M. (Niels Bohr Inst., Copenhagen, Denmark). *Journal of Physics A: Mathematical and General;* **16**: 3219-3236(1983).

Some simple closed-form approximations are derived for the oscillatory part of the Wigner function F for a system of degenerate fermions completely filling the first M shells of an oscillator potential in N dimensions. The formalism for a general dimensionality is retained since various properties of the physical case (N=3) may be related to similar systems in one dimension higher or lower. In particular the magnitude of the oscillations increases with N, but it is shown that if the last shell is only half filled the structure is decreased to that obtained for a closed-shell system in one dimension lower. The structure is shown to decrease slowly in the classical or macroscopic limit of large particle number, when the density is shown to tend to its Thomas-Fermi value. The formula for the full-shell case is sufficiently simple to generalize to the problem of almost degenerate fermions at a finite temperature T, where it is seen that substantial damping of the oscillations may be obtained for any particle number. An explicit expression for the damping is derived and this implies that for deep-inelastic nuclear reactions at a temperature of around 2 to 3 MeV, considerable structure may still be present in F. A simple expression relating the Fermi energy and the particle number of the system at finite temperature is given.

50924 **Relation between the variable moment of inertia model and the interacting boson model.** Scharff-Goldhaber, G. (Brookhaven National Lab., Upton, NY (USA)). pp 365-372 of Proceedings of 1982 INS international symposium on dynamics of nuclear collective motion, at the foot of Mt. Fuji. High spin states and transitional nuclei. Ogawa, K.; Tanabe, K. (eds.). Tokyo, Japan; Tokyo Univ., Inst. for Nuclear Study (1982). (CONF-820738—).

From INS symposium on dynamics of nuclear collective motion; Mount Fuji, Japan (6 Jul 1982).

Two phenomenological descriptions of the low energy part of band structure observed in even-even nuclei have been successfully used for the analysis of experimental data. Those are the variable moment of inertia (VMI) model and the interacting boson model (IBM or IBA). In this paper, five issues between two models are discussed. The first one is the role of the pairing force. The pairing force does not explicitly appear in VMI equation, whereas the IBA Hamiltonian contains a pairing force term. However, a revised formalism by the recent study eliminated the pairing term from the IBA Hamiltonian. The second is the region of validity of the models. The validity of VMI at the near magic limit was revealed. The IBA is not applicable to the nuclei close to the magic limit, at present. The third is that there is a close relation between the VMI parameters and the three dynamical symmetries of IBA. The fourth problem is the phase transition. The phase transition can be explained by both models. Finally, the relation between the moment of inertia and the quadrupole moment is discussed. It appears that the IBA can only be extended toward the magic limit, and the VMI and IBA are eventually combined in a new unified model, if the steps connected with the extension and testing of VMI are retraced.

50925 **Evaluation of (n,n') scatteriung cross sections from 0.8 to 2.5 MeV for higher collective bands of ^{232}Th and ^{238}U in "standard" (CN + DI) and "unified" (Weidenmerller s-matrix) formalisms.** Sheldon, E.; Chan, D.W.S. Lowell, MA, USA; University of Lowell (1982). 29p. Department of Physics, University of Lowell, MA 01854.

Angle-integrated cross sections for inelastic scattering of fast neutrons from 0.8 to 2.5 MeV on ^{232}Th and ^{238}U, proceeding to higher collective (quadrupole and octupole vibrational) states in the residual nuclei, have been computed in a standard and a unified approach; the resulting excitation functions have been compared with the experimental data of the Lowell group. In all calculations, a consistent set of optical potential and deformation parameters, as derived by Haouat and Lagrange of the Bruyeres group, was used. The standard formalism employed an incoherent sum of compound-nucleus (CN) and coupled-channels direct-interaction (DI) cross section, evaluated with the programs CINDY and KARJUP (Karlsruhe version of JUPITOR) respectively. Provision was made for the effect of level-width fluctuations and for competing neutron exit channels. The results in general compared well with the measured values, but in several instances disagreed significantly with the ENDF/B-V evaluated data. Still better agreement ensued from the use of the unified formalism based upon energy-averaged second moments of transformed S-matrix elements in a statistical approach developed by Weidenmueller at al. and embodied within a new fluctuation program NANCY with coupled channels and competing channels to generate and manipulate the grand ensemble of S-matrix elements. With only the coupling strengths as adjustable parameters, this offers a promising, reliable means of analysis well suited to the interpretation of neutron scattering on deformed actinide nuclei.

6540 Radiation And Shielding Physics

REFER ALSO TO CITATION(S) 65400050127

50926 **(CONF-8404190—4) Studies of charged-particle tracks in liquid water.** Hamm, R.N.; Turner, J.E.; Wright, H.A. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000902.

From Warner-Brandt workshop on penetration phenomena: in elastic near-surface interaction; Oak Ridge, TN, USA (12 Apr 1984).

Purpose of this paper is to show various appearances of the track structure when considered on different spatial scales. Different pictures are shown of parts of the same track produced by a 1-MeV proton in water. (DLC)

50927 **(DOE/EV/03861—49) Vacuum ultraviolet electronic properties of liquids. Annual progress report, February 1, 1984-January 31, 1985.** Painter, L.R. (Tennessee Univ., Knoxville (USA). Dept. of Physics and Astronomy). 1984. Contract AS05-76EV03861. 30p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85000305.

The work on collective electronic oscillations in the silicone liquid Dow Corning 705 was revised. Newly analyzed data on electron bombardment gave better agreement with results of analyzed vuv optical reflectance values for energy loss than earlier results indicated. As previously reported, electron and photon mean free paths and absolute photoyields were calculated from reanalyzed liquid water data in the 2 to 25 eV region. These electron mean free paths were calculated from formamide electron mean free paths scaled for valence electron density. The formamide mean free paths were derived using Born approximation by Ashley and Williams. An alternate approach to calculation of electron mean free path in organic and inorganic matter proposed by Seah and Dench has been followed. A paper detailing the water data and discrepancies in electron mean free path is in preparation. A survey of a range of liquids with request to reflectivity and photoemission was completed. Absorbance measurements in the 25,000 to 2700 A region were made on a number of the insulating liquids. As a result, a series of n-ethylene glycols with particularly high dipole moments was chosen for study. The main thrust of the current contract period has been a study of these liquids which include ethylene glycol, diethylene glycol, triethylene glycol and tetraethylene glycol.

50928 **(HMI-B—403) Optimization of flat and horizontally curved neutron monochromators for given diffractometer geometries.** Graf, H.A. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (Germany, F.R.). Bereich Kernchemie und Reaktor). Aug 1983. 161p. NTIS (US Sales Only), PC A08/MF A01. File Number DE84751520.

The computer program MONREF was written for calculating the integrated intensity and the k-vector distribution produced by mosaic-crystal monochromators in neutron diffractometers of given geometries. The program treats flat and horizontally curved monochromators in Bragg reflection. Its basic algorithm is derived from Zachariasen's coupled differential equations which were modified to include the case of asymmetrically cut crystals. The calculations are restricted to the scattering in the experimental plane. In the first part of the report the program and its applications are described. In the second part a compilation of intensities is presented< caLculated for crystals of Cu, Si, Ge and pyrolytic graphite commonly used as monochromators, in a standard diffractometur configuration.

50929 **(INER—0498) SKYSHINE-P: a point kernel computer program for calculating SKYSHINE exposure rates.** Chou, D.P.; Hsiao, T.P.; Lai, G.H. (Institute of Nuclear Energy Research, Lung-Tan (Taiwan). Technical Information Center). Feb 1983. 28p. (In Chinese). NTIS (US Sales Only), PC A03/MF A01. File Number DE85900132.

A simple point kernel model for air-scattered gamma-rays is presented. Exposure rates arising from a vertically collimated point source are calculated by SKYSHINE-P. The results are shown to be in good agreement with benchmark experimental data while proper buildup factors have been used.

50930 (INIS-mf—9052, pp 20) **Theoretical and experimental investigation on neutron transport in moderating and shielding materials.** Khristov, V.; Ilieva, K.; Stanolov, A.; Vojkov, G.; Jordanov, J.; Stancheva, N.; Gadzhokov, V. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). 1983. (In Bulgarian). NTIS (US Sales Only), PC A99/MF A01. File Number TI84780548. (CONF-8309253—Absts.).

From 1. national congress of the physicists in Bulgaria; Sofia, Bulgaria (28 Sep 1983).

50931 (INIS-SU—247, pp 40-43) **Angular dependence of helium ion energy losses in gold.** Zhukova, Yu.N.; Iferov, G.A. 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. File Number TI84780555. (CONF-8205270—).

From 12. All-Union conference on physics of interaction between charged particles and crystals; Moscow, USSR (25 May 1982).

Experimental data on He^{+}, He^{++} energy losses depending on the impact parameter rho are presented. The dependence of energy transfered by ions to atoms in collisions on the impact parameter Q(p) is obtained by mere change of variables from experimentally measured dependence Q(Q), where Q is the scattering angle. Measurements are performed at energies E=200, 300, 400 and 500 keV for He^{+} and He^{++} ions and at energies E=800 and 1000, for H^{++} alone. A gold polycrystalline film 180 A thick is used as a target, scattered particles are registered by a semiconductor detector with the resolution of 9 keV.

50932 **Computational study of discretization error for the upwind finite-difference approximation to the Spencer-Lewis equation.** Nelson, P.; Ray, A.K.; Seth, D.L. (Texas Tech Univ., Inst. for Numerical Transport Theory, P.O. Box 4319, Lubbock, TX 79409). *Transactions of the American Nuclear Society;* **46**: 436-438(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

50933 **Simulating electron energy loss fluctuations in deterministic streaming ray calculations.** Filippone, W.L.; Woolf, S. (University of Arizona, Tucson, AZ 85721). *Transactions of the American Nuclear Society;* **46**: 435-436(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

50934 **Monte Carlo simulation of electron/photon/Cherenkov cascades in generalized geometry.** Mack, J.M.; Jordan, T.M. (Los Alamos National Laboratory, P.O. Box 1663, Los Alamos, NM 87545). *Transactions of the American Nuclear Society;* **46**: 434-435(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

6550 Medical Physics

REFER ALSO TO CITATION(S) 65500050361, 50362

50935 (INIS-mf—9007) **Exposition index calculation from different points in a gamma sterilization plant radiation room.** Carrasco, A.H. (Universidad Nacional Autonoma de Mexico, Mexico City. Facultad de Quimica). 1983. 61p. (In Spanish). NTIS (US Sales Only), PC A04/MF A01. File Number DE85780004.

Radiation fields produced by a JS-6500 rectangular irradiator source were evaluated. Knowledge of the values of these fields is necessary in irradiation and health physics processes. Techniques for evaluating the dose rates from puntual, linear and plane sources were applied and computer programs for the three sources designed. Fricke, cupric-ferrous and red acrilic dosimetric systems were used, to verify the eight points located along the interior walls of the irradiation room, around the source with 936, 987 Ci of Co-60 (1st-March 1980). When considering the distance between the source and each point of interest the calculated exposition indexes obtained were practically the same for the three source types and were up to 35% greater than the experimental values; in contrast when absorption and buildup of the source were taken into account, the experimental values were higher than the calculated ones by up to 16%, thus in estimating the produced exposition index for a rectangular source at least two parameters should be included.

50936 (INIS-mf—9053, pp 23-26) **Dose limits for radiological workers.** Barendsen, G.W. (Amsterdam Univ. (Netherlands). Lab. voor Radiobiologie). 1982. (In Dutch). NTIS (US Sales Only), PC A05/MF A01. File Number TI85780001. (CONF-820199—).

From Occupational health aspects of ionising radiation meeting; Amsterdam, Netherlands (6 Jan 1982).

The ICRP recommendations nos. 9 and 26 for dose limits for radiological workers are explained and compared. The author's conclusion is that the new ones are an improvement of the previous ones, facilitating their execution in various applications of ionizing radiations or radio-active materials.

50937 (INIS-mf—9053, pp 11-22) **Industrial doctor and radiation hygiene at ECN.** Carpaij, W.J.M. (Stichting Energieonderzoek Centrum Nederland, Petten). 1982. (In Dutch). NTIS (US Sales Only), PC A05/MF A01. File Number TI85780001. (CONF-820199—).

From Occupational health aspects of ionising radiation meeting; Amsterdam, Netherlands (6 Jan 1982).

The organisation of the health service department of the Netherlands Energy Research Centre where a nuclear reactor is maintained in operation, is divided into three working groups: (1) the occupational health service, (2) the radiation inspection service, and (3) the safety control service. Next to these, there are three groups which also render services to outsiders, viz. the analytical, the instrumentation, and the biological control services. The task and place of each of these is elucidated. The industrial doctor's main task is the supervision of the medical surveillance of all personnel members, counseling of the radiological workers, and treatment of radiation accidents.

50938 (INIS-mf—9053, pp 41-48) **Radiological work in a university centre. Occupational health problems.** Westerman, B. (Katholieke Univ. Nijmegen (Netherlands)). 1982. (In Dutch). NTIS (US Sales Only), PC A05/MF A01. File Number TI85780001. (CONF-820199—).

From Occupational health aspects of ionising radiation meeting; Amsterdam, Netherlands (6 Jan 1982).

In this paper the author outlines the problems of the industrial doctor's tasks in a university centre with physics laboratories and a hospital with medical laboratories. An inventory of problems is presented. The solutions are not easy because of the interdependence of medical, physical and technical inspectors. The health hazards appear to be low.

50939 (INIS-mf—9053, pp 52-60) **Training of medical radiation experts for the occupational health services.** Carpaij, W.J.M. (Stichting Energieonderzoek Centrum Nederland, Petten). 1982. (In Dutch). NTIS (US Sales Only), PC A05/MF A01. File Number TI85780001. (CONF-820199—).

From Occupational health aspects of ionising radiation meeting; Amsterdam, Netherlands (6 Jan 1982).

The author deals with all requirements, old and new, which should be fulfilled in a training schedule for physicians wanting to become a medical expert in radiation hygiene. He draws his points from an advice presented to the Labor Office of the Ministry of Social Affairs in the Netherlands, composed by a working group of which he was a member. In the appendix to this article a review is presented of the need for this type of expert over the next 10 years, and the cost of training the necessary number of experts.

50940 (OEFZS—4269) **Austrian primary standard for ionizing radiation dosimetry. Results of international intercomparisons.** Duftschmid, K.E.; Leitner, A. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). Mar 1984. 18p. (ST—113/84). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703139.

The Austrian Dosimetry Laboratory Seibersdorf, established and operated by the Austrian Federal Office of Measures and the Research Center Seibersdorf contains the national primary standards for radiation dosimetry. For photon radiation in the energy range up to 500 keV three free-air-parallel-plate-chambers covering the range of 7-30 kV, 20-100 kV and 50-500 kV are used. For gamma radiation mainly of cesium 137 and cobalt 60 graphite

cavity absolute chambers with measured volume are applied. In addition for high energy photon and electron radiation as frequently used in radiotherapy a portable graphite calorimeter is used as primary standard for absorbed dose measurement. All these instruments have been constructed and manufactured in Seibersdorf in close cooperation with the Hungarian National Office of Measures. The accuracy of measurement has been determined by international intercomparisons with the 'Bureau International des Poids et Mesures' (BIPM) Paris, the 'Amt fuer Standardisierung, Messwesen und Warenpruefung' of the German Democratic Republic (ASMW) Berlin and the Hungarian National Office of Measures (OMH) Budapest.

6560 Solid State Physics

REFER ALSO TO CITATION(S) 65600050203, 50854, 50892, 50973, 50974

50941 **(BNL—35226) Propagation of sound at continuous structural phase transitions.** Schwabl, F. (Brookhaven National Lab., Upton, NY (USA); Technische Univ. Muenchen, Garching (Germany, F.R.). Fakultaet fuer Physik). 1984. Contract AC02-76CH00016. 31p. (CONF-8405240—1). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85001345.

From Transport and propagation in nonlinear systems; Los Alamos, NM, USA (21 May 1984).

Structural phase transitions of 2nd order can be divided into two groups: (1) Distortive Phase Transitions, with a soft (ultimately overdamped) optic mode, (2) Elastic Phase Transitions, with an acoustic soft mode or no soft phonon for shear or isostructural transitions, respectively. The propagation of sound shows significantly different features in these two cases. We consider the theory of the critical variation of the velocity of ultrasonic modes as well as the damping and dispersion near transitions of 2nd order. 48 references.

50942 **(CONF-831187—19-Draft) Experimental studies of random-field effects in uniaxial random antiferromagnets.** Wong, P.Z.; Cable, J.W.; von Molnar, S.; Dimon, P. (Oak Ridge National Lab., TN (USA); Schlumberger-Doll Research Center, Ridgefield, CT (USA); IBM Watson Research Center, Yorktown Heights, NY (USA)). Nov 1983. Contract AC05-84OR21400. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85001180.

From 29. annual conference on magnetics and magnetic materials; Pittsburgh, PA, USA (8 Nov 1983).

We discuss how random fields (RFs) are generated in uniaxial random antiferromagnets (URAFs) by applied fields and review the experiments that have been performed on these systems. They include direct and indirect specific heat measurements, neutron scattering experiments and phase diagram studies. We compare the results of different experiments on different systems, discuss their implications on the theories, and suggest further experiments. A new explanation for the Lorentzian-squared (LSQ) structure factor observed in the neutron scattering experiments is also given. 47 references, 4 figures.

50943 **(CONF-831265—5) Optically induced intervalence-band transitions in germanium by the absorption of 1.06 μm picosecond pulses.** James, R.B. (Oak Ridge National Lab., TN (USA)). Jan 1984. Contract AC05-84OR21400. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000946.

From 6. international conference on lasers and applications; San Francisco, CA, USA (12 Dec 1983).

The intervalence-band absorption coefficient in germanium is calculated as a function of the hole density and temperature for light with a wavelength of 1.06 μm. This absorption mechanism is normally negligible compared to the interband absorption; however, for a sufficiently dense electron-hole plasma, the free-hole intervalence-band absorption can become comparable to the interband absorption. Furthermore, the interaction of intense 1.06 μm light can alter the distribution of resonantly-coupled hole states and lead to an intensity dependence in the intervalence-band absorption cross section. For a fixed hole density, the intervalence-band cross sections due to free-hole transitions between the heavy- and split-off hole bands and between the light- and split-off hole bands are found to decrease with increasing intensity in a manner closely approximated by an inhomogeneously broadened two-level model. Values for the saturation intensity of each resonant transition are calculated as a function of the hole density and temperature. The intensities required to begin to saturate the direct free-hole transitions are easily attainable using picosecond pulses. 31 references.

50944 **(CONF-831265—6) Electron-hole plasma formation in semiconductors due to the absorption of pulsed CO_2 laser light.** James, R.B. (Oak Ridge National Lab., TN (USA)). Jan 1984. Contract AC05-84OR21400. 18p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001559.

From 6. international conference on lasers and applications; San Francisco, CA, USA (12 Dec 1983).

A calculation is presented to describe the modification of the carrier distribution due to the presence of high-intensity CO_2 laser radiation for several semiconductors. In the calculation the intercarrier collision rates are assumed to be sufficiently large that the distribution can be described by a carrier temperature, which may be much larger than the lattice temperature. The steady-state carrier temperature is calculated as a function of the light intensity by equating the rate at which the carriers receive energy from the electromagnetic field and the rate at which the carriers lose energy to the lattice by the emission of phonons. For sufficiently high light intensities, a significant fraction of the total free carrier density can have a kinetic energy which exceeds the bandgap. These hot carriers are energetically capable of relaxing by undergoing an inelastic pair-producing scattering event. This impact ionization process can lead to the formation of a laser-induced plasma by the absorption of light well below the bandgap of the material. Explicit values are presented for the intensity thresholds at which the impact ionization processes become important for light in the 9 to 11 μm region. Comparison of the results with transmission measurements indicates that this mechanism may be responsible for the nonlinear absorption observed in several semiconductors by high-intensity pulsed CO_2 laser light. 39 references, 12 figures.

50945 **(CONF-840417—5) Ferromagnetism in metals at finite temperatures.** Gyorffy, B.L.; Staunton, J.B.; Stocks, G.M. (Oak Ridge National Lab., TN (USA); Bristol Univ. (UK). H.H. Wills Physics Lab.; Imperial Coll. of Science and Technology, London (UK). Dept. of Mathematics). 1984. Contract AC05-84OR21400. 16p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000898.

From High-temperature alloys - theory and design conference; Bethesda, MD, USA (8 Apr 1984).

The conventional spin-polarized band theory is well known to give a reasonable description of the magnetic ground states of metals. Here it is generalized to finite temperatures. The resulting theory is the first first-principles theory of the ferromagnetic phase transition in metals. It is a mean-field theory. For iron we find T/sub c/ = 1250 K and chi^{-1}(q = 0) follows a Curie-Weiss law. We also report on our results for the wave-vector dependent susceptibility chi(q) which is a measure of magnetic short-range order above T/sub c/.

50946 **(CONF-840417—7) Resistivity of alloys.** Butler, W.H. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 16p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000906.

From High-temperature alloys - theory and design conference; Bethesda, MD, USA (8 Apr 1984).

The problem of calculating the electrical resistivity of metals and alloys is briefly reviewed, and a new theory for the transport properties of random alloys is presented. The new theory is based on the Korringa-Kohn-Rostoker Coherent-Potential-Approximation and allows the calculations of the transport coefficients of real alloys from first principles without the need for adjustable parameters. It reduces to the Boltzmann equation when the energy bands are well defined, but it is also applicable when the electronic mean free path is so short that the energy bands can no longer be defined. 26 references.

50947 (INIS-SU—247, pp 12-16) **Axial channeling in a thick monocrystal.** Kadmenskij, A.G.; Lebedev, N.Yu.; Naumova, N.M.; Tulinov, A.F.; Samarin, V.V. 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. File Number TI84780555. (CONF-8205270—).

From 12. All-Union conference on physics of interaction between charged particles and crystals; Moscow, USSR (25 May 1982).

The binary encounter model for channeled particles and atomic chains (BEA model), the mathematical basis of which is the analytical expressions for the scattering angle in the transverse plane and the length of collision with the chain, is described. Particle motion in the sample is represented as a series of consequent collisions with orderly arranged "crystal" chains. The values of the azimuthal angle and the 500 keV proton paths in silicon and gold monocrystals obtained in the suggested model and calculated in the BEA model by the Monte-Carlo method are in good agreement.

50948 (INIS-SU—247, pp 17-21) **Accounting for temperature dependence at description and simulation of axial channeling.** Samarin, V.V.; Kadmenskij, A.G. 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. File Number TI84780555. (CONF-8205270—).

From 12. All-Union conference on physics of interaction between charged particles and crystals; Moscow, USSR (25 May 1982).

Analytic expressions containing temperature dependence both for values averaged in the stat-equilibrium distribution in the transverse phase space ("stat-equilibrium" values) and for their alterations in the elementary act of scattering the channeled particle at the separate atomic chain are obtained. The following characteristics of channeled particles are considered: the yield of close collisions with chain atoms, mean square deltaΩ^2 fluctuation in direction of particle velocity vector due to multiple scattering on atomic nuclei and electrons and energy losses for the case when the effect of thermal shift of atoms from equilibrium positions prevails over the discretion effect of the chamber; and the scattering result depends but slightly on its nature. The analytic expressions presented permit to simulate particle scattering at the atomic chain in a simple way.

50949 (INIS-SU—247, pp 22-27) **Peculiarities of two-dimensional particle motion at axial channeling.** Cherdyntsev, V.V. 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. File Number TI84780555. (CONF-8205270—).

From 12. All-Union conference on physics of interaction between charged particles and crystals; Moscow, USSR (25 May 1982).

Peculiarities of two-dimensional particle motion under axial channeling are considered. Periodic trajectory for the cell with mirror reflection at the boundary and for the cell with periodic boundary conditions, are investigated. The effect of unstable periodic trajectories on the distribution of particles is considered. The possibility of interpreting peculiarities inherent to axial channeling is shown by investigating periodic trajectories in the transverse plane.

50950 (INIS-SU—247, pp 48-51) **Decay of a packet incident on monocrystal and evolution of a two-particle system and its motion in medium.** Filippov, G.M. 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. File Number TI84780555. (CONF-8205270—).

From 12. All-Union conference on physics of interaction between charged particles and crystals; Moscow, USSR (25 May 1982).

The decay of the wave packet falling from vacuum on monocrystal is considered as well as the evolution of proton-electron system in the motion process in metal. It is shown that after the flight into the crystal the wave packet reconstructs and transforms in the narrow packet which moves either in one of the channels, or in the arbitrary direction, or undergoes a strong reflection in the field of one of lattice nuclei with a definite probability determined by the vacuum value of density matrix. The proton propagating in the metal appears in the localized state, and along with the electron can form the system of the so-called "classical atom". When flying into vacuum "the classic atom" will possess a higher positive energy due to strong localization of constituting particles and will decay into conventional vacuum states of atom or ion.

50951 (INIS-SU—247, pp 52-55) **Theory of orientational acoustic effect at channeling.** Denisov, F.P.; Il'in, S.I.; Zabaev, V.N. 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. File Number TI84780555. (CONF-8205270—).

From 12. All-Union conference on physics of interaction between charged particles and crystals; Moscow, USSR (25 May 1982).

The orientation acoustic effect is considered as the result of action of elastic high-frequency waves excited in the crystal by channeling electrons. It is shown that pressure of elastic waves calculated according to the above model agrees well with the pressure value measured in the course of experiment in the order of value.

50952 (INIS-SU—247, pp 118-120) **Radiation at particle scattering in ultrathin crystals.** Kaplin, V.V. 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. File Number TI84780555. (CONF-8205270—).

From 12. All-Union conference on physics of interaction between charged particles and crystals; Moscow, USSR (25 May 1982).

Radiation characteristics occurring during flight of positrons through an ultrathin crystal in the case of single elastic deviation of beam particles, are considered. It is shown that monochromatic nature of obtained radiation can be increased by passing the particle through several crystals placed at equal distance from one another. Measuring this distance, it is possible to smoothly regulate the frequency of generated radiation in a wide range without changing its angular distributions.

50953 (INIS-SU—247, pp 121-124) **Rainbow scattering and relativistic electron radiation in crystals at motion along axis.** Shul'ga, N.F.; Truten', V.I.; Fomin, S.P. 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. File Number TI84780555. (CONF-8205270—).

From 12. All-Union conference on physics of interaction between charged particles and crystals; Moscow, USSR (25 May 1982).

Results of investigations into scattering and radiation of relativistic electrons in the crystal in the case when the continual potential of a separate atomic chain is the Lindhard potential, are presented. To describe the motion of relativistic particles in the crystal at a small angle to one of crystalline axes, the approximation of the continual chain-crystal potential averaged over this axis, is used. It is shown that in the case of electron scattering the effect of rainbow particle scattering takes place in the crystal and that radiation spectrum of superbar electrons contains a sharp peak in the range of low frequencies.

50954 (INIS-SU—247, pp 104-107) **Radiation at planar channeling of relativistic electrons in thick crystals.** Bajer, V.N.; Katkov, V.M.; Strakhovenko, V.M. 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. File Number TI84780555. (CONF-8205270—).

From 12. All-Union conference on physics of interaction between charged particles and crystals; Moscow, USSR (25 May 1982).

Spectral distribution of radiation intensity in a given space angle (collimator), is considered for the case of electron planar channeling; the optimum thickness is determined at which radiation outlet (with respect to energy losses by electrons to irradiation and absorption of irradiated photons) is maximum. Results of calculations of spectral distribution of radiation intensity in crystals of crystal type for potential of the "upturned parabola" type at the energy E=1 GeV, are presented. It is shown that at the given collimation angle radiation spectrum practically does not deform as the electron passes through the crystal.

6561 Superconductivity

REFER ALSO TO CITATION(S) 65610050129, 50132, 50141

50955 **(LBL—18193) Chaos and related nonlinear noise phenomena in Josephson tunnel junctions.** Miracky, R.F. (Lawrence Berkeley Lab., CA (USA)). Jul 1984. Contract AC03-76SF00098. 139p. NTIS, PC A07/MF A01; GPO Dep. File Number DE85000393.

Thesis.

The nonlinear dynamics of Josephson tunnel junctions shunted by a resistance with substantial self-inductance have been thoroughly investigated. The current-voltage characteristics of these devices exhibit stable regions of negative differential resistance. Very large increases in the low-frequency voltage noise with equivalent noise temperatures of 10^6 K or more, observed in the vicinity of these regions, arise from switching, or hopping, between subharmonic modes. Moderate increases in the noise, with temperatures of about 10^3 K, arise from chaotic behavior. Analog and digital simulations indicate that under somewhat rarer circumstances the same junction system can sustain a purely deterministic hopping between two unstable subharmonic modes, accompanied by excess low-frequency noise. Unlike the noise-induced case, this chaotic process occurs over a much narrower range in bias current and is destroyed by the addition of thermal noise. The differential equation describing the junction system can be reduced to a one-dimensional mapping in the vicinity of one of the unstable modes. A general analytical calculation of switching processes for a class of mappings yields the frequency dependence of the noise spectrum in terms of the parameters of the mapping. Finally, the concepts of noise-induced hopping near bifurcation thresholds are applied to the problem of the three-photon Josephson parametric amplifier. Analog simulations indicate that the noise rise observed in experimental devices arises from occasional hopping between a mode at the pump frequency ω/sub p/ and a mode at the half harmonic ω/sub p//2. The hopping is induced by thermal noise associated with the shunt resistance. 71 references.

6570 Theoretical Physics

REFER ALSO TO CITATION(S) 65700050387, 50811, 50814, 50941

50956 (INIS-mf—9052, pp 9) **Theory of generalized observables in quantum mechanics.** Todorov, T. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). 1983. (In Bulgarian). NTIS (US Sales Only), PC A99/MF A01. File Number TI84780548. (CONF-8309253—Absts.).

From 1. national congress of the physicists in Bulgaria; Sofia, Bulgaria (28 Sep 1983).

50957 (INIS-mf—9052, pp 13) **Geometry of supergravitation.** Ogievetskij, V.; Sokachev, E. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1983. (In Bulgarian). NTIS (US Sales Only), PC A99/MF A01. File Number TI84780548. (CONF-8309253—Absts.).

From 1. national congress of the physicists in Bulgaria; Sofia, Bulgaria (28 Sep 1983).

50958 (INIS-mf—9052, pp 14) **Equations with non zero energy momentum tensor for the gravitational field.** Manov, S. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). 1983. (In Bulgarian). NTIS (US Sales Only), PC A99/MF A01. File Number TI84780548. (CONF-8309253—Absts.).

From 1. national congress of the physicists in Bulgaria; Sofia, Bulgaria (28 Sep 1983).

50959 (INIS-mf—9052, pp 15) **Theory of gravitational field.** Donev, S. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). 1983. (In Bulgarian). NTIS (US Sales Only), PC A99/MF A01. File Number TI84780548. (CONF-8309253—Absts.).

From 1. national congress of the physicists in Bulgaria; Sofia, Bulgaria (28 Sep 1983).

50960 (INIS-mf—9052, pp 16) **Solutions of the cosmological equations with cylindrical symmetry in space parts of the metrical interval.** Veselinov, G. (Sofia Univ. (Bulgaria). Katedra po Atomna Fizika). 1983. (In Bulgarian). NTIS (US Sales Only), PC A99/MF A01. File Number TI84780548. (CONF-8309253—Absts.).

From 1. national congress of the physicists in Bulgaria; Sofia, Bulgaria (28 Sep 1983).

50961 (INIS-mf—9052, pp 17) **Class of solutions of the Einstein's equations. Solutions of the equations of the geodesics.** Veselinov, G. (Sofia Univ. (Bulgaria). Katedra po Atomna Fizika). 1983. (In Bulgarian). NTIS (US Sales Only), PC A99/MF A01. File Number TI84780548. (CONF-8309253—Absts.).

From 1. national congress of the physicists in Bulgaria; Sofia, Bulgaria (28 Sep 1983).

50962 (INIS-mf—9052, pp 18) **4- atomism. One-dimensional potential dimple.** Karabsky, B.; Evtimova, E. (Sofia Univ. (Bulgaria). Katedra po Atomna Fizika). 1983. (In Bulgarian). NTIS (US Sales Only), PC A99/MF A01. File Number TI84780548. (CONF-8309253—Absts.).

From 1. national congress of the physicists in Bulgaria; Sofia, Bulgaria (28 Sep 1983).

50963 **(KFKI—1983-103) Quantum relativity theory.** Banai, M. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Nov 1983. 53p. NTIS (US Sales Only), PC A04/MF A01. File Number DE84703091.

A quantum relativity theory formulated in terms of Davis' quantum relativity principle is outlined. The first task in this theory as in classical relativity theory is to model space-time, the arena of natural processes. It is argued that the quantum space-time models of Banai introduced in an earlier paper is formulated in terms of Davis' quantum relativity. Then it is shown that the recently proposed classical relativistic quantum theory of Prugovecki and his corresponding classical relativistic quantum model of space-time open the way to introduce in a consistent way the quantum space-time model (the 'canonically quantized Minkowski space') proposed by Banai earlier. The main new aspect of the quantum mechanics of the quantum relativistic particles is, in this model of space-time, that it provides a true mass eigenvalue problem and, that the excited mass states of such particles can be interpreted as classifically relativistic (massive) quantum particles ('elementary particles'). The question of field theory over quantum relativistic models of space-time is also discussed. Finally, it is suggested that 'quarks' should be considered as quantum relativistic particles.

50964 **(KFKI—1983-105) Electrovac solutions with common shearing geodesic eigenrays.** Lukacs, B. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Oct 1983. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703097.

The spatially symmetric electrovac problem is investigated in the General Relativity with common geodesic and shearing eigenrays. It is shown that all these solutions are Ernst counterparts of the corresponding vacuum solutions.

50965 **(KFKI—1983-115) One-loop infinities in dimensionally reduced supergravities.** Fradkin, E.S.; Tseytlin, A.A. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Nov 1983. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703098.

It is proved explicitly in the paper that d=4 theory following via reduction from N=1, d=10 supergravities is not finite at one loop while the version of N=8 supergravity directly following from N=1, d=11 theory is one-loop finite. The method used is based on quantization of initial higher dimensional theory as a first step. The results also suggest possible existence of non-standard (higher N) d>4 supergravities which reduce to d=4 theories with finite N=8 supergravity sector.

50966 (KFKI—1983-116) New results in quantum supergravity. Fradkin, E.S.; Tseytlin, A.A. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Nov 1983. 60p. NTIS (US Sales Only), PC A04/MF A01. File Number DE84703099.

A review of the authors' recent works on problems in background field method and quantum properties of gauged and conformal supergravities is presented. One-loop effective potential in gauged 0(4) supergravity is calculated and possibility of dynamical breaking of local supersymmetry is shown to exist. Also, a mechanism for quantum solution of Λ-term problem in gauged supergravities is discussed. The absence of conformal anomalies in theories with local conformal invariance is proposed as a necessary requirement for their consistency. Several superconformal theories are shown to be candidates for an anomaly-free finite theory. The relevance of (gauge and gravitational) instantons as background which can be employed for establishing exact β-functions in gauged and conformal supergravities is suggested. It is proved that one-loop infinities in N>=3 gauged 0(N) supergravities are produced only by corresponding zero modes when calculated on De Sitter and SO(N) gauge instanton backgrounds. Analogous property is shown to be true for gravitational self-dual, De Sitter and SU(N) gauge instantons in N>=1, N>=3 conformal supergravities.

50967 (LA-UR—84-2750) Reduction of the wavepacket: how long does it take. Zurek, W.H. (Los Alamos National Lab., NM (USA); California Univ., Santa Barbara (USA). Inst. for Theoretical Physics). 1984. Contract W-7405-ENG-36. 6p. (CONF-8406194—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE84016778.

From NATO advanced study institute on nonequilibrium quantum statistical mechanics; Santa Fe, NM, USA (3 Jun 1984).

We show that the reduction of the wavepacket caused by the interaction with the environment occurs on a timescale which is typically many orders of magnitude shorter than the relaxation timescale tau. In particular, we show that in a system interacting with a canonical heat bath of harmonic oscillators decorrelation timescale of two pieces of the wavepacket separated by N thermal de Broglie wavelengths is approximately tau/N^2. Therefore, in the classical limit h bar → O dynamical reversibility (tau → ∞) is compatible with instantaneous coherence loss.

50968 (LA-UR—84-2773) What are squeezed states really like. Nieto, M.M. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 22p. (CONF-8406194—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE85002014.

From NATO advanced study institute on nonequilibrium quantum statistical mechanics; Santa Fe, NM, USA (3 Jun 1984).

The simple harmonic oscillator and some quantum mechanics are reviewed. Then a special case of the squeezed states, the coherent states, is discussed. Next, the coherent states are described from the operator formalism. The squeezed states are described from the Schroedinger point of view, and their properties are discussed. Harmonic motion and coherent and squeezed states are discussed for general potentials. Then the (harmonic oscillator) squeezed states are discussed from the operator point of view and some of their mathematical properties. (WHK)

50969 (TUM-M—8314) Repeated measurements in quantum theory. Castrigiano, D.P.L.; Mutze, U. (Technische Univ. Muenchen (Germany, F.R.). Inst. fuer Mathematik). Sep 1983. 31p. Library of Technische Univ. Muenchen (Germany, F.R.). Fakultaet fuer Mathematik und Informatik.

Limiting formulae are deduced for the state of a quantum system which is subjected to a continual sequence of subsequent measurements of the same dichotomic observable. In the case of a semibounded Hamiltonian the dynamics usually gets reduced to the subspace spanned by the eigenstates of the observable. In particular the values of the observable "freeze". Exceptions from freezing occur for states which cannot be approximated by eigenstates of finite energy.

50970 (UNIGRAZ-UTP—04-84) Particles in spherical electromagnetic radiation fields. Mitter, H.; Thaller, B. (Graz Univ. (Austria)). Mar 1984. 28p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84703092.

If the time-dependence of a Hamiltonian can be compensated by an appropriate symmetry transformation, the corresponding quantum mechanical problem can be reduced to an effectively stationary one. With this result we investigate the behavior of nonrelativistic particles in a spherical radiation field produced by a rotating source. Then the symmetry transformation corresponds to a rotation. We calculate the transition probabilities in Born approximation. The extension to problems involving an additional Coulomb potential is briefly discussed.

50971 (UNIGRAZ-UTP—05-84) Factorization theorem for an exponential operator. Mitter, H.; Yamazaki, K. (Graz Univ. (Austria)). Mar 1984. 4p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703093.

An exponential of the sum of three operators can be factorized formally as a product of three exponentials, if the three operators form a closed algebra.

50972 (UNIGRAZ-UTP—06-84) Representation for spherical harmonics of rotated argument. Mitter, H.; Yamazaki, K. (Graz Univ. (Austria)). Mar 1984. 4p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703094.

By means of a factorization formula given in a previous letter we derive a representation for spherical harmonics of rotated argument in terms of those with unrotated one.

50973 (UWThPh—84-08) Solitons in solid state physics. Grosse, H. (Vienna Univ. (Austria)). 1984. 5p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703095.

We construct all reflexionless charge symmetric potentials of the Dirac equation, identify them as solitons of the MKdV equation, show the connection to the KdV solitons and indicate the relevance for polyacetylene.

50974 (UWThPh—84-09) Ground state energy of an interacting bose gas. Conlon, J. (Vienna Univ. (Austria)). 1984. 5p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703096.

The purpose of this article is to describe some progress in understanding the ground state energy of an interacting Bose gas. In particular we would like to understand if a formula obtained by Bogoliubov does in fact give the correct value for the ground state energy. The validity of the Bogoliubov approximation is examined for a finite and the infinite box.

50975 (UWThPh—84-14) Stochastic quantization of the linearized gravitational field. Rumpf, H. (Vienna Univ. (Austria)). 1984. 4p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703100.

The stochastic quantization scheme of Parisi and Wu 1984 exhibits an Euclidean quantum field psi(x) as the stationary limit of a stochastic relaxation process defined by the Langevin equation. The Euclidean Green's functions are obtained as the 'equilibrium limit' of n-point time dependent correlation functions <psi(x_1)...psi(xsub(n))> = lim <psi(t_1, x_1)...psi(tsub(n), xsub(n))>sub(eta). t_1=...=tsub(n)→ infinity. The advantage of this method for the continuous field theories is that in gauge theories the perturbative calculation of the n-point time - dependent correlation function can be based on the classical action alone. In attempts to apply this scheme to the gravitational field certain difficulties are encountered even at the linearised level. The equation above is modified to account for these difficulties.

50976 (UWThPh—84-15) Gravitational field strength and generalized Komar-integral. Simon, W. (Vienna Univ. (Austria)). 1984. 27p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84703101.

We define a 'gravitational field strength' in theories of the Einstein-Cartan type admitting a Killing-vector. This field strength is a second rank, antisymmetric, divergence-free tensor, whose ('Komar-') integral over a closed 2-surface gives a physically mean-

ingful quantity. We find conditions on the Lagrange-density of the theory which ensure the existence of such a tensor, and show that they are satisfied for N = 2-supergravity and for a special case of the bosonic sector of N = 4-supergravity. We discuss a possible application of the generalized Komar-integral in the theory of stationary black holes. We also consider the Kaluza-Klein-approach to the 'field-strength-problem', which turns out to be particularly rewarding in the application to black holes.

50977 **Gravity as a dynamical consequence of the strong, weak, and electromagnetic interactions.** Zee, A. (Dept. of Physics, FM-15, Univ. of Washington, Seattle, WA 98195). pp 403-418 of Unification of the fundamental particle interactions II. Vol. 15. Ellis, J.; Ferrara, S. New York, NY, USA; Plenum Publishing Corp. (1983). (CONF-8110291—).

From Europhysics study conference; Erice, Italy (6 Oct 1981).

In this paper it is argued that Newton's gravitational constant G is calculable, and a specific calculation of G for a class of gauge theories is given. A brief review of past studies of G, especially its scale invariance, scalar fields, and the quantization of gravity, is given. A formula for G that expresses in precise terms the author's philosophy that gravity is induced as a result of quantum fluctuations, as well as a Feynam diagram representing the formula, is derived. Finally, such a calculation of G in the real world, though not yet possible, is anticipated.

6580 Mathematical Physics

50978 **(INER—0514) Solving of inverse Z-transfer function by recurrent permutation method.** Wang, C.Y. (Institute of Nuclear Energy Research, Lung-Tan (Taiwan)). Jul 1983. 34p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85900149.

In general, a lot of matrix manipulations are needed to find an inverse Z-transfer function. Basically, a total of KTxNxN times of multiplications, exclusive of additions, are required for a N-order inverse Z-transfer function to get results for KT discrete points. In this article, an efficient method which, taking good advantage of the characteristics of the matrix formed with the transfer function coefficients, can reduce multiplications and additions to only 2xKTxN times for the same amount of results is proposed. This approach is called Recurrent Permutation Method. It can save a lot of computer time by significantly reducing the multiplications needed. As multiplications in the linear domain are equivalent to additions in the logarithmic domain, the algorithms developed in both domains are included in a computer program. The choice based on the characteristics of the desired applications is left to the user.

50979 (INIS-mf—9052, pp 10) **Asymptotic functions - Fourier transformation.** Khristov, Kh.; Damyanov, Bl.; Todorov, T. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). 1983. (In Bulgarian). NTIS (US Sales Only), PC A99/MF A01. File Number TI84780548. (CONF-8309253—Absts.).

From 1. national congress of the physicists in Bulgaria; Sofia, Bulgaria (28 Sep 1983).

50980 (INIS-mf—9052, pp 3) **Gauge equivalent difference evolution equations.** Gerdzhikov, V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1983. (In Bulgarian). NTIS (US Sales Only), PC A99/MF A01. File Number TI84780548. (CONF-8309253—Absts.).

From 1. national congress of the physicists in Bulgaria; Sofia, Bulgaria (28 Sep 1983).

50981 **(UWThPh—84-13) Algebra of two-component spinors. A revision.** Urbantke, H. (Vienna Univ. (Austria)). 1984. 21p. (In German). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703090.

An overview of the algebra of two-component spinors and of four-component spinors based on abstract linear algebra is given. The role of spinors for the complex Lorentz group and for all of its real forms is worked out.

6590 Communication, Education, History, And Philosophy

REFER ALSO TO CITATION(S) 65900050939

70 FUSION ENERGY

7001 Plasma Research

REFER ALSO TO CITATION(S) 70010050498

50982 (CLM-CD—1983-Vol.1, pp 1-10) **Review of current drive by fast ion injection.** Cordey, J.G. (Commission of the European Communities, Abingdon (UK). JET Joint Undertaking). 1983. NTIS (US Sales Only), PC A14/MF A01. File Number TI84780551. (CONF-830452—Vol.1).

From Technical meeting on non-inductive current drive in tokamaks; Abingdon, UK (18 Apr 1983).

A review is given of current drive by neutral injection. The near-term and long-term potential of current drive by ion beams is discussed.

50983 (CLM-CD—1983-Vol.1, pp 71-82) **Minority ICRF current drive in toroidal geometry.** Chan, V.S.; Chiu, S.C. (GA Technologies, Inc., San Diego, CA (USA)). 1983. NTIS (US Sales Only), PC A14/MF A01. File Number TI84780551. (CONF-830452—Vol.1).

From Technical meeting on non-inductive current drive in tokamaks; Abingdon, UK (18 Apr 1983).

An important advantage of the ICRF minority heating scheme over other schemes is that there are several parameters, namely, the choice of minority ion species, its concentration, and the parallel wave number ksub(parallel to) spectrum, that one could adjust and control for optimized experimental conditions. Furthermore, wave penetration and heating have been demonstrated experimentally to be as good or better than many other auxiliary heating schemes. The possibility that minority ICRF can be used to sustain a toroidal plasma current for the steady-state operation of a tokamak reactor is examined.

50984 (CLM-CD—1983-Vol.1, pp 83) **Current drive by ICRF heating of alpha-particles and beam ions.** Okano, K. (Princeton Univ., NJ (USA). Plasma Physics Lab.). 1983. NTIS (US Sales Only), PC A14/MF A01. File Number TI84780551. (CONF-830452—Vol.1).

From Technical meeting on non-inductive current drive in tokamaks; Abingdon, UK (18 Apr 1983).

A current drive scheme based on combining neutral beam-injection and ICRF wave heating is discussed. The neutral beam injection mainly supplies toroidal momentum and is sustained by ICRF wave heating. The current is generated with sufficient efficiency and can sustain the tokamak plasma in a steady state. The application of this mechanism to alpha-particle driven current is considered.

50985 (CLM-CD—1983-Vol.1, pp 103-107) **ICRF enhancement of beam-driven currents.** Cox, M.; Start, D.F.H. (UKAEA Culham Lab., Abingdon). 1983. NTIS (US Sales Only), PC A14/MF A01. File Number TI84780551. (CONF-830452—Vol.1).

From Technical meeting on non-inductive current drive in tokamaks; Abingdon, UK (18 Apr 1983).

A study is presented of ICRF enhancement of beam-driven currents.

50986 (CLM-CD—1983-Vol.1, pp 108-113) **Nonlinear theory of lower hybrid current drive - a two-dimensional Fokker-Planck study.** Chan, V.S.; Liu, C.S.; McClain, F.W. (GA Technologies, Inc., San Diego, CA (USA)). 1983. NTIS (US Sales Only), PC A14/MF A01. File Number TI84780551. (CONF-830452—Vol.1).

From Technical meeting on non-inductive current drive in tokamaks; Abingdon, UK (18 Apr 1983).

It is demonstrated using a two-dimensional (in velocity) Fokker-Planck code that an electron distribution sustained by lower hybrid waves is unstable to magnetized plasma waves in a regime of experimental interest. The temporal evolution of the distribution in the presence of these waves is examined and a physical picture obtained of how fast electrons are generated and how these electrons gain a significant amount of perpendicular energy and sustain a large current.

50987 (CLM-CD—1983-Vol.1, pp 124-154) **Two-dimensional and relativistic effects in lower-hybrid current drive.** Hewett, D.; Hizanidis, K.; Krapchev, V.; Bers, A. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). 1983. NTIS (US Sales Only), PC A14/MF A01. File Number TI84780551. (CONF-830452—Vol.1).

From Technical meeting on non-inductive current drive in tokamaks; Abingdon, UK (18 Apr 1983).

New numerical and analytic solutions of the two-dimensional Fokker-Planck equation supplemented by a parallel quasilinear diffusion term are presented. The results show a large enhancement of the perpendicular temperature of both the electrons resonant with the applied RF fields and the more energetic electrons in the tail. Both the RF generated current and power dissipated are substantially increased by the perpendicular energy broadening in the resonant region. In the presence of a small DC electric field the RF current generated is very much enhanced, much more than in a simple additive fashion. A relativistic formulation of the two-dimensional Fokker-Planck quasilinear equation is presented. From conservation equations, based upon this formulation, the characteristics of RF current drive with energetic electrons are derived. These show how the RF driven current and its figure of merit (I/Psub(d)) increase with the energy of the current-carrying electrons, and that their perpendicular, random momentum must also increase.

50988 (CLM-CD—1983-Vol.1, pp 155-160) **Interpretation of LH current drive experiments.** Canobbio, E.; Croci, R. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). 1983. NTIS (US Sales Only), PC A14/MF A01. File Number TI84780551. (CONF-830452—Vol.1).

From Technical meeting on non-inductive current drive in tokamaks; Abingdon, UK (18 Apr 1983).

A ponderomotive mechanism for upshifting the nsub(parallel to)-spectrum of LH wave launchers, which may explain the experimental findings on current drive is described.

50989 (CLM-CD—1983-Vol.1, pp 161-172) **Runaways and current drive.** Kritz, A.H.; Appert, K.; Muschietti, L.; Vaclavik, J. (Centre de Recherches en Physique des Plasmas, Lausanne (Switzerland)). 1983. NTIS (US Sales Only), PC A14/MF A01. File Number TI84780551. (CONF-830452—Vol.1).

From Technical meeting on non-inductive current drive in tokamaks; Abingdon, UK (18 Apr 1983).

The effects of runaway superthermal electrons are discussed. It is shown that the effects of runaways on electron cyclotron current drive may be more important than the effects runaways have on lower hybrid current drive.

50990 (CLM-CD—1983-Vol.1, pp 173-177) **Numerical simulation of current drive by lower hybrid waves.** Bernard, M. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de la Physique du Plasma et de la Fusion Controlee). 1983. NTIS (US Sales Only), PC A14/MF A01. File Number TI84780551. (CONF-830452—Vol.1).

From Technical meeting on non-inductive current drive in tokamaks; Abingdon, UK (18 Apr 1983).

A model of power absorption and current drive by lower hybrid waves is coupled to the Culham Icarus 1D transport code. The model refers to the quasilinear electron Landau damping theory and includes toroidal effects on propagation by using a ray tracing technique. Application to Petula and Tore Supra machines is made with the aim of replacing half or totality of the ohmic current by RF driven current. The results show that it could be obtained with a reasonable amount of RF power. During operation the RF driven current density is progressively shifted towards the plasma edge. This undesirable effects is related to the transport coefficients which are used in the model and needs further studies.

50991 (CLM-CD—1983-Vol.1, pp 178-189) **Computational model for lower hybrid current drive.** Englade, R.C.; Bonoli, P.T.; Porkolab, M. (Massachusetts Inst. of Tech., Cambridge (USA)). 1983. NTIS (US Sales Only), PC A14/MF A01. File Number TI84780551. (CONF-830452—Vol.1).

From Technical meeting on non-inductive current drive in tokamaks; Abingdon, UK (18 Apr 1983).

A detailed simulation model for lower hybrid (LH) current drive in toroidal devices is discussed. This model accounts reasonably well for the magnitude of radio frequency (RF) current observed in the PLT and Alcator C devices. It also reproduces the experimental dependencies of RF current generation on toroidal magnetic field and has provided insights about mechanisms which may underlie the observed density limit of current drive.

50992 (CLM-CD—1983-Vol.1, pp 190-195) **Velocity redistribution in lower hybrid current drive.** Decyk, V.K.; Morales, G.J.; Dawson, J.M. (California Univ., Los Angeles (USA). Center for Plasma Physics and Fusion Engineering). 1983. NTIS (US Sales Only), PC A14/MF A01. File Number TI84780551. (CONF-830452—Vol.1).

From Technical meeting on non-inductive current drive in tokamaks; Abingdon, UK (18 Apr 1983).

A review is presented of number of computer experiments in current generation with lower hybrid waves. These simulations were performed with a particle simulation code which calculates the trajectories of about 1/4 million particles in their self-consistent (electrostatic) fields plus the fields due to an external antenna.

50993 (CLM-CD—1983-Vol.1, pp 196-201) **rf current drive in the presence of a dc electric field.** Canobbio, E.; Croci, R. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). 1983. NTIS (US Sales Only), PC A14/MF A01. File Number TI84780551. (CONF-830452—Vol.1).

From Technical meeting on non-inductive current drive in tokamaks; Abingdon, UK (18 Apr 1983).

The 2D QLFP equation is solved analytically for an electron gas in the presence of a LH wave travelling parallel to a weak DC electric field. In the strong RF field limit it is found that the DC field has no effect besides weak, purely Ohmic heating (and current drive), and that a quasi-plateau develops in the perpendicular electron velocity distribution which substantially increases the values of the induced current and the absorbed power (but not of their ratio) with respect to the 1D estimates.

50994 (CLM-CD—1983-Vol.1, pp 202-217) **Stochastic generation of currents by lower-hybrid waves.** Gell, Y.; Nakach, R. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de la Physique du Plasma et de la Fusion Controlee). 1983. NTIS (US Sales Only), PC A14/MF A01. File Number TI84780551. (CONF-830452—Vol.1).

From Technical meeting on non-inductive current drive in tokamaks; Abingdon, UK (18 Apr 1983).

A scheme for current generation based on a stochastic driving mechanism is proposed. The current in this approach is generated by launching into the plasma two lower-hybrid waves having appropriate different frequencies, wave-numbers and amplitudes. The phase-space analysis of the electron motion in such a configuration reveals the existence of a relatively broad stochastic layer far away from the separatrix, allowing for diffusion in velocity space of high velocity electrons. The diffusion coefficient of this process is evaluated and the solution of the Fokker-Planck equation for the electron velocity distribution function is used to calculate the current J and the power dissipated Psub(d), in generating it. A favourable J to Psub(d) ratio for steady-current drive is found.

50995 (CLM-CD—1983-Vol.1, pp 218-223) **Plasma heating and current drive in a tokamak by the fast mode of low hybrid waves.** Grekov, D.L.; Dyakov, V.Ye.; Stepanov, K.N. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1983. NTIS (US Sales Only), PC A14/MF A01. File Number TI84780551. (CONF-830452—Vol.1).

From Technical meeting on non-inductive current drive in tokamaks; Abingdon, UK (18 Apr 1983).

Plasma heating and current drive in tokamaks by a fast mode (FM) of the fast magnetosonic waves with the frequency ω of the order of the low hybrid frequency ωsub(LH) as compared with the slow mode (SM) waves is discussed. The peculiarities of the FM propagation and damping at ω approx. ωsub(LH) in a tokamak plasma are examined using a ray tracing technique.

50996 (CLM-CD—1983-Vol.1, pp 224-249) **Study of the current drive by the lower hybrid wave in a tokamak.** Yamamoto, T. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). 1983. NTIS (US Sales Only), PC A14/MF A01. File Number TI84780551. (CONF-830452—Vol.1).

From Technical meeting on non-inductive current drive in tokamaks; Abingdon, UK (18 Apr 1983).

Effective current drive for the electron density of n-barsub(e) approx. 6 x $10^{18}m^{-3}$ by the lower hybrid waves (corresponding to fsub(0)/fsub(1h)(O) approx. 2.3) has been obtained experimentally in the JFT-2 tokamak. Soft X-ray measurements for the low density shows significant modification of the energy distribution function of the electrons, which led to the resultant driven current, in the center of the plasma. The ineffective current drive for n-barsub(e) > 6 x 10^{18} m^{-3} is correlated with excitation of parametric decay instabilities. The observed interaction of the lower hybrid waves with the electrons for a range of the density is well explained by a coupled quasi-linear Fokker-Planck equation with the loss term resulting from magnetic fluctuations.

50997 (CLM-CD—1983-Vol.1, pp 250-277) **Lower hybrid current drive experiments on the Alcator C and the Versator II tokamaks.** Lloyd, B.; Porkolab, M.; Schuss, J.J. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). 1983. NTIS (US Sales Only), PC A14/MF A01. File Number TI84780551. (CONF-830452—Vol.1).

From Technical meeting on non-inductive current drive in tokamaks; Abingdon, UK (18 Apr 1983).

On the Alcator C tokamak, lower hybrid current drive experiments are being carried out using two sixteen-waveguide array couplers. With the first antenna up to 650 kW of RF power has been injected at 4.6 GHz into the plasma for time durations up to 200 ms. The plasma current can be maintained at a constant level of 160 kA with zero loop voltage at a maximum electron density of n-barsub(e) = 5.5 x $10^{13}cm^{-3}$ by injecting 600 kW of RF power into the plasma. The RF current drive is strongly dependent on the phasing of adjacent waveguides, with maximum current drive efficiency obtained at Δphi approx. 60° to 90°. Measurements of the hard x-ray spectrum at a density of n-barsub(e) approx. 5 x $10^{13}cm^{-3}$ indicated an RF produced energetic tail component with photon energies up to 300 keV. In the absence of the RF power, there is no measurable level of x-ray emission above 30 keV.

50998 (CLM-CD—1983-Vol.1, pp 278-297) **Interaction of lower hybrid waves with fast electron tails in FT.** Santini, F.; De Marco, F.; Barbato, E.; Tuccillo, A. (Centro Ricerche Energia Frascati, Rome, (Italy). EURATOM-ENEA sulla Fusione). 1983. NTIS (US Sales Only), PC A14/MF A01. File Number TI84780551. (CONF-830452—Vol.1).

From Technical meeting on non-inductive current drive in tokamaks; Abingdon, UK (18 Apr 1983).

In the LH experiment on the FT tokamak (f + 2.45 GHz, P < 250 kW) operating at low plasma density (n-bar <= 4.10^{13} cm^{-3}) a strong interaction of LH waves was observed. This interaction which is responsible for current drive in other experiments, is studied in a wide range of plasma parameters. The most striking feature is the sharp density cut-off occurring at n-bar = 4.10^{13} cm^{-3} and having a weak dependence on plasma parameters and working gas. The principal experimental results on wave-electron interaction are reported and an extended discussion is given.

50999 (CLM-CD—1983-Vol.1, pp 299-312) **Lower hybrid current drive in the PLT tokamak.** Motley, R.; Bernabei, S.; Chu, T.K.; Efthimion, P.; Hooke, W.; Jobes, F.; Stevens, J.; Valeo, E.; Goeler, S. von (Princeton Univ., NJ (USA). Plasma Physics Lab.). 1983. NTIS (US Sales Only), PC A14/MF A01. File Number TI84780551. (CONF-830452—Vol.1).

From Technical meeting on non-inductive current drive in tokamaks; Abingdon, UK (18 Apr 1983).

The characteristics of steady-state (long pulse) and transient discharges in PLT, driven by up to 600 kW of power from a 6-element, 800 MHz lower hybrid grill, are described.

51000 **(CLM-CD—1983-VOL.1) Non-inductive current drive in tokamaks.** Start, D.F.H. (ed.). (UKAEA Culham Lab., Abingdon). 1983. 305p. (CONF-830452—Vol.1). NTIS (US Sales Only), PC A14/MF A01. File Number DE84780551.

From Technical meeting on non-inductive current drive in tokamaks; Abingdon, UK (18 Apr 1983).

Separate entries for each paper were entered into the data base. (MOW)

51001 **(CONF-840311—16) Comparison of electron cyclotron heating theory and experiment in EBT.** Batchelor, D.B. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 22p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000895.

From 4. international symposium on heating in toroidal plasmas; Rome, Italy (21 Mar 1984).

It is shown that the microwave power P/sub μ/ effectively vanishes near Ω/sub e/ (s) ≃ ω. The implication of this is that for fixed ϵ passing particles are preferentially heated and for fixed pitch angle high energy particles are preferentially heated. The effect of the heating is to increase v/sub perpendicular to/, pushing passing particles toward the trapped-passing boundary where confinement is poor.

51002 **(CONF-840922—1) Far-infrared laser diagnostic on EBT and extreme far-forward laser scattering on ISX.** Casson, W.H.; Hutchinson, D.P.; Ma, C.H.; Staats, P.A.; Wilgen, J.B. (Tennessee Univ., Knoxville (USA); Oak Ridge National Lab., TN (USA)). Sep 1984. Contract AC05-84OR21400. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001788.

From 5. APS topical conference on high temperature plasma diagnostics; Tahoe City, CA, USA (16 Sep 1984).

A far-infrared (FIR) laser scattering diagnostic has been installed on the ELMO Bumpy Torus (EBT) experiment, and tests conducted on the system using a TPX Bragg cell show that the system is fully functional. Scattering experiments to date have shown only small detectable signal levels during normal operation and during ion cyclotron heating (ICH) fast-wave and slow-wave propagation experiments. On the Impurity Study Experiment (ISX) the output signal from the rf amplifiers of the FIR interferometer has been spectrum analyzed and shows frequency-shifted sidebands that correspond to extreme far-forward scattering of the laser beam as it passes through the plasma. Although the scattered signal cannot be resolved spatially, the scattered intensity provides information about density fluctuation levels and MHD activity during different modes of operation. Agreement has been found with measurements made by the x-ray diagnostic and the heavy-ion beam probe.

51003 **(DOE/ET/53003—2) Theoretical investigations relevant to magnetic fusion research.** Kammash, T. (Michigan Univ., Ann Arbor (USA). Dept. of Nuclear Engineering). 1984. Contract AC02-76ET53003. 14p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001777.

Substantial and significant progress on several fronts of our investigations has been achieved since our last renewal proposal. A brief discussion of these results and their relevance to on-going national experiments will precede the proposed work in each area.

51004 **(DOE/ET/53003—3) Theoretical investigations relevant to magnetic fusion research, April 1, 1983-March 31, 1984.** Kammash, T. (Michigan Univ., Ann Arbor (USA). Dept. of Nuclear Engineering). 1984. Contract AC02-76ET53003. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001778.

Our research effort in the past year has focused on two major objectives: (1) analytical modeling of the Tandem Mirror Experiments; and (2) a study of the stability of the interchange and ballooning modes in EBT with relativistic hot electrons. As may be noted from the progress reports, we have made substantial progress in both directions. In carrying out these studies we have singled out areas in which further improvements need and can be made. The results obtained thus far, and the problems we wish to address in the future are described.

51005 **(DOE/ET/53088—154-Pt.A) Shear-Alfven dynamics of toroidally confined plasmas. Part A.** Hazeltine, R.D.; Meiss, J.D. (Texas Univ., Austin (USA). Inst. for Fusion Studies). Aug 1984. Contract FG05-80ET53088. 173p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE85001590.

Recent developments in the stability theory of toroidally confined plasmas are reviewed, with the intention of providing a picture comprehensible to non-specialists. The review considers a class of low-frequency, electromagnetic disturbances that seem especially pertinent to modern high-temperature confinement experiments. It is shown that such disturbances are best unified and understood through consideration of a single, exact fluid moment: the shear-Alfven law. Appropriate versions of this law and its corresponding closure relations are derived - essentially from first principles - and applied in a variety of mostly, but not exclusively, linear contexts. Among the specific topics considered are: flux coordinates (including Hamada coordinates), the Newcomb solubility condition. Shafranov geometry, magnetic island evolution, reduced MHD and its generalizations, drift-kinetic electron response, classical tearing, twisting, and kink instabilities, pressure-modified tearing instability (Δ-critical), collisionless and semi-collisional tearing modes, the ballooning representation in general geometry, ideal ballooning instability, Mercier criterion, near-axis expansions, the second stability region, and resistive and kinetic ballooning modes. The fundamental importance of toroidal topology and curvature is stressed.

51006 **(DOE/ET/53088—154-Pt.B) Shear-Alfven dynamics of toroidally confined plasmas. Part B.** Hazeltine, R.D.; Meiss, J.D. (Texas Univ., Austin (USA). Inst. for Fusion Studies). Aug 1984. Contract FG05-80ET53088. 160p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE85001787.

This part covers radial boundary layer theory and the eikonal theory of pressure driven modes. (MOW)

51007 **(INIS-mf—9063) Wills Plasma Physics Department annual progress report.** (Sydney Univ. (Australia). Dept. of Plasma Physics). 1983. 40p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84703107.

The experimental program on the research tokamak TORTUS has concentrated on fundamental studies of hydromagnetic waves in toroidal geometry, on preliminary experiments for an Alfven wave heating program, and on further development of diagnostics and data acquisition equipment. Highlights of the work were the observation of magnetically guided Alfven wave packets in toroidal geometry and of strong toroidal effects in the loading of a half-turn loop antenna in the low frequency Alfven wave regime. In work on the linear SUPPER IV machine magnetically guided Alfven and acoustic waves were observed. Theoretical work on plasma waves supported the experimental studies. The development of laser diagnostic techniques is also reported.

51008 **(KFKI—1983-100) Transition scattering and transition bremsstrahlung in a dense plasma - a step towards soft x-ray lasers.** Bakos, J.S.; Tsytovich, V.N. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Oct 1983. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703108.

The possibility of construction of soft x ray laser is discussed in a laser plasma. Plasma wave is induced in the plasma by crossed laser beams. A relativistic electron beam crosses the plasma permeability wave and soft x rays are generated by the mechanism of transition scattering. The feedback is realized by the high order Bragg-scattering on the periodic structure of the plasma wave.

51009 **(UCRL—90160) Plasma-surface interactions in large tandem mirror devices - MFTF-B.** Allen, S.L. (Lawrence Livermore National Lab., CA (USA)). 7 May 1984. Contract W-7405-ENG-48. 41p. (CONF-840520—19). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85001753.

From 6. international conference on plasma surface interactions in controlled fusion devices; Nagoya, Japan (14 May 1984).

Present experiments on TMX-U and modeling of MFTF-B indicate that plasma-surface interactions can be controlled in MFTF-B. The MFTF-B configuration uses a hot electron population created by ECRH and a sloshing-ion population created by neutral beams in the thermal barrier region to create a potential that confines the central cell ions. Neutral beams and ICRH are used to heat the central cell ions. Plasma-surface interactions can be minimized at radial surfaces by control of the axial confinement of the edge plasma. The thermal barrier configuration is sensitive to the background neutral density, and requires low wall reflux and efficient shielding by the edge plasma. Glow discharge cleaning, titanium gettering, and control of the gas from neutral beams will be used to provide wall conditioning and to reduce the background gas pressure. The shielding efficiency of the plasma edge has been modeled in MFTF-B by comparing computer codes with current experimental measurements. In addition, it is very important to reduce high-energy neutral-beam-injected impurities; this is accomplished by using gettering or magnetic separation in the injector systems. Plasma-edge scrapers, diverter-like devices, and direct-conversion equipment will be located in the end region. Major disruptions are not anticipated. Finally, MFTF-B will also test some technological issues that are revelant to reactors: superconducting magnet systems and nearly steady-state (30-s) operation.

51010 **(UCRL—91330) Measurement of proton autoneutralization potential.** Garcia, M. (Lawrence Livermore National Lab., CA (USA)). Sep 1984. Contract W-7405-ENG-48. 14p. (CONF-840922—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85001752.

From 5. APS topical conference on high temperature plasma diagnostics; Tahoe City, CA, USA (16 Sep 1984).

A proton space charge having multi-MeV kinetic energy was injected through a thin ground plane to extract electrons and produce a time-dependent autoneutralization space potential. An electon-emitting floating-potential resistive divider was used to measure the space potential during 20 ns of the proton current pulse. During this time, proton kinetic energy fell from 10.6 MeV to 8.5 MeV and thus the space potential (taken as 1.09 x the floating potential) fell from 5.8 kV to 4.6 kV.

51011 **Evidence of a laser intensity threshold for the onset of inhibited electron transport.** Rosen, M.D. (Lawrence Livermore National Lab., CA). *Comments on Plasma Physics and Controlled Fusion;* **8**: No. 5, 165-175(Mar 1984).

A review is given of the results of recent experiments performed at many different laboratories on electron thermal transport in plastic targets irradiated with 1.06 μm laser light. The results are analysed in a unified fashion via LASNEX simulations. An intriguing picture emerges which requires the need to invoke inhibited transport if the absorbed laser intensity is above a threshold of mid 10^{13} W cm^{-2}. Previous evidence for such a threshold is also discussed.

51012 **Effect of radial transport on tandem mirror end loss.** Campbell, R.B.; Logan, B.G. (TRW Systems, Redondo Beach, CA). *Comments on Plasma Physics and Controlled Fusion;* **8**: No. 3, 95-101(Jan 1984).

The introduction of radial transport effects into the kinetic equations describing axial transport will reduce the axial transport for a fixed value of ion confining potential. The importance of this

reduction will depend upon the velocity space dependence of the radial losses. Some results are presented.

51013 **Simulating field-reversed magnetic-mirror fusion devices.** Brengle, T.A.; Cohen, B.I.; Steward, M.E. (Lawrence Livermore National Lab., Berkeley, CA). *Computer;* vp(1983). Contract W-7405-ENG-48.

Nuclear energy research at Lawrence Livermore National Laboratory indicates that field-reversed magnetic mirror machines may offer greater efficiency and higher electrical yields than current reactor designs. Since theoretical analysis of the FRM is difficult, the ion kinetics and electron physics of a fusion plasma are modeled to analyze the buildup and decay processes that might be characteristic of an actual machine. A simulation has been developed that accurately models the developing current distribution. An array processor is used to obtain faster run times.

7002 Fusion Power Plant Technology

REFER ALSO TO CITATION(S) 70020050095, 50113

51014 (CLM-CD—1983-Vol.1, pp 11-33) **Optimization of tokamak reactors with beam-driven current.** Mikkelsen, D.R.; Singer, C.E. (Princeton Univ., NJ (USA). Plasma Physics Lab.). 1983. NTIS (US Sales Only), PC A14/MF A01. File Number TI84780551. (CONF-830452—Vol.1).

From Technical meeting on non-inductive current drive in tokamaks; Abingdon, UK (18 Apr 1983).

Tokamak reactors have been optimized with neutral beam-driven current in two modes of operation: steady state, and cycled current drive. The essentials of the O-d reactor model are reviewed, and the major results are presented.

51015 (CLM-CD—1983-Vol.1, pp 34-41) **Dilution effect in beam-driven current experiments.** Hugill, J.; Clark, W.H.M. (UKAEA Culham Lab., Abingdon). 1983. NTIS (US Sales Only), PC A14/MF A01. File Number TI84780551. (CONF-830452—Vol.1).

From Technical meeting on non-inductive current drive in tokamaks; Abingdon, UK (18 Apr 1983).

An account is given of beam-driven current experiments on DITE tokamak.

51016 (CLM-CD—1983-Vol.1, pp 42-61) **Progress report on negative ion beams based on User Development Workshop on negative ion based neutral beams, 15-16 February, 1983, Princeton.** Green, T.S. (UKAEA Culham Lab., Abingdon). 1983. NTIS (US Sales Only), PC A14/MF A01. File Number TI84780551. (CONF-830452—Vol.1).

From Technical meeting on non-inductive current drive in tokamaks; Abingdon, UK (18 Apr 1983).

Progress in the development of negative ion sources and their application in fusion research is reviewed.

51017 (CLM-CD—1983-Vol.1, pp 62-70) **Neutral beam current drive in TFTR.** Nikkelsen, D.R. (Princeton Univ., NJ (USA). Plasma Physics Lab.). 1983. NTIS (US Sales Only), PC A14/MF A01. File Number TI84780551. (CONF-830452—Vol.1).

From Technical meeting on non-inductive current drive in tokamaks; Abingdon, UK (18 Apr 1983).

The procedure used to calculate the beam-driven current in TFTR is described. The rationale for optimizing the plasma configuration is presented along with the results of the plasma simulations. It is found that it may be possible to drive <approx. 0.5 MA for times which are greater than the current-relaxation timescale.

51018 **(CONF-830942—88) Critical radius and critical number of gas atoms for cavities containing a Van der Waals gas.** Coghlan, W.A.; Mansur, L.K. (Arizona State Univ., Tempe (USA); Oak Ridge National Lab., TN (USA)). 1983. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001259.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

The effect of gas on void nucleation and growth is particularly important for structural materials in fusion reactors because of the high production of helium by neutron-induced transmutation reactions. Gas reduces the critical radius for bias driven growth and there is a critical number of gas atoms, n/sub g/*, at which the critical radius is reduced essentially to zero. The significance of this is that the time interval to the accumulation of n/sub g/* gas atoms may determine the time to the onset of bias driven swelling where n/sub g/* is large. In previous papers these critical quantities were given for an ideal gas. Recently, we presented the results for a Van der Waals gas. Here the derivation of these relations is presented and further results of calculations are given. At low temperatures (high pressures) the results depart from those of the ideal gas, with the critical number affected more strongly than the critical radius. Comparisons are made with earlier calculations.

51019 **(CONF-831203—174) Assembly and installation of a pair of superconducting buses for the Large Coil Test Facility.** Moore, J.W. (Union Carbide Corp., Oak Ridge, TN (USA). Nuclear Div.). 1983. Contract AC05-84OR21400. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000952.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

The Large Coil Test Facility in Oak Ridge, Tennessee, was built to test six large tokamak-type superconducting coils. The test facility is designed to test these coils in an environment which simulates that of a tokamak. Current is supplied to the coil through the high current leads in the Superconducting Bus Assembly. Two of these assemblies interface with each test coil inside the test facility vacuum vessel and with the vapor-cooled lead assemblies outside the vacuum vessel. Since the high current leads are required to be superconducting, the Bus Assembly is designed to be filled with liquid helium for cooling. Under some test conditions, there is relative motion between the coil interface and the vacuum vessel interface. The Bus Assemblies are designed to accommodate this motion plus thermal conditions. This paper provides a detailed review of the design, fabrication, assembly, and installation of a typical bus pair.

51020 **(CONF-831203—175) MFTF-α+T: an upgrade to the MFTF-B.** Nelson, W.D.; Doggett, J.N. (Oak Ridge National Lab., TN (USA); Lawrence Livermore National Lab., CA (USA)). 1983. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000950.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

Several options for upgrading the MFTF-B physics and nuclear performance have been considered. Early in FY83, these upgrades were proposed to the fusion community. The one most favorably received was the MFTF-α+T. The proposed implementation will permit two modes of operation. One mode emphasizes better confinement and higher Q. A physics goal is to achieve a central cell Q of 2. At this point, about one-third of the central cell heating comes from alpha particles. At the proposed Q of 2, the power out of the center cell plasma is twice that of the input power to the plasma. The second operating mode emphasizes high fusion power production and high neutron wall loading in the central cell. This is achieved with a center cell insert module, which promises a wall loading of 2 MW/m². This mode will provide a unique opportunity for operating a power-producing blanket section at reactor-like parameters.

51021 **(CONF-831203—176) D-T axicell magnet system for MFTF-α+T.** Srivastava, V.C. (Oak Ridge National Lab., TN (USA)). 1983. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000949.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

The configuration and design of the deuterium-tritium (D-T) axicell superconducting magnets for the Mirror Fusion Test Facility (MFTF-α+T) are described. The MFTF-α+T is an upgrade of the MFTF-B, with new end-plug magnets and a neutron-producing central D-T axicell section. The 4-m long axicell - its length defined

by the 12-T peaks in the mirror field - is beam fueled and heated by two beam lines, each with four neutral beam injection ports. Two large superconducting coils (means diameter ~ 3.8 m) located at Z = +-2.40 m, in conjunction with a small copper coil located outside the test volume region, produce the 4.5-T mirror midplane field. This background field is augmented by two copper coils to create the 12-T peak mirror fields at Z = +-2 m. The central region of the axicell accommodates a 1-m-long, replaceable blanket test module. The length (4 m) of the axicell was chosen to provide relatively uniform neutron wall loading over the test module. In many respects, this axicell is less than full scale, but it could be viewed as a short section of a reactor, complete with the support systems and technologies associated with a mirror reactor. The peak field at the superconducting coils is 10.8 T. The coils employ hybrid superconducting winding - Nb_3Sn conductor in the 8- to 12-T region and NbTi in the 0- to 8-T region. The winding is cryostable and is cooled by a 4.2 K liquid helium bath. The conductor design, the winding design, and the performance analyses for these superconducting coils are described.

51022 **(CONF-831203—177) Advanced performance fusion engineering device based on low safety factor and current drive (FED-A).** Peng, Y.K.M.; Rutherford, P.H. (Oak Ridge National Lab., TN (USA); Princeton Univ., NJ (USA). Plasma Physics Lab.). 1983. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000947.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

The FED-A study aims to quantify the potential improvement in cost-effectiveness of the Fusion Engineering Device (FED) by assuming low safety factor q at the plasma edge and noninductive current drive. The FED-A performance objectives (ignition, neutron wall load, and power-reactor-like operation) are set to be equal to or better than those of the FED Baseline. The results show that assuming magnetohydrodynamic (MHD) q/sub psi/(edge) to be 1.8 permits reduction in device size and plasma current and leads to a 30% reduction in direct cost. A closely fitted, 1.5-cm-thick, continuous water-cooled shell made of the copper alloy AMAX-MZC (0.6 Cr, 0.1 Zr, 0.03 Mg) is proposed to provide a 0.5-s time constant, to help avoid disruption when q/sub psi/ passes near 2, and to mitigate disruption impact. The lower hybrid wave current drive in a cyclic density operation is proposed to achieve a quasi-steady-state operation permitting a design with low toroidal loop voltage and a 1000-s burn time.

51023 **(CONF-831203—178) Using PAFEC as a preprocessor for MSC/NASTRAN.** Gray, W.H.; Baudry, T.V. (Oak Ridge National Lab., TN (USA); PAFEC Engineering Consultants, Knoxville, TN (USA)). 1983. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000955.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

Programs for Automatic Finite Element Calculations (PAFEC) is a general-purpose, three-dimensional, linear and nonlinear finite element program. PAFEC's features include free-format input using engineering keywords, powerful mesh-generating facilities, sophisticated database management procedures, and extensive data validation checks. Presented here is a description of a software interface that permits PAFEC to be used as a preprocessor for MSC/NASTRAN. This user-friendly software, called PAFMSC, frees the stress analyst from the laborious and error-prone procedure of creating and debugging a rigid-format MSC/NASTRAN bulk data deck. By interactively creating and debugging a finite element model with PAFEC, thus taking full advantage of the free-format, engineering-keyword-oriented data structure of PAFEC, the stress analyst can drastically reduce the amount of time spent during model generation. The PAFMSC software will automatically convert a PAFEC data structure into an MSC/NASTRAN bulk data deck. The capabilities and limitations of the PAFMSC software are fully discussed in the following report.

51024 **(CONF-831203—179) Tritium pellet injection sequences for TFTR.** Houlberg, W.A.; Milora, S.L.; Attenberger, S.E.; Singer, C.E.; Schmidt, G.L. (Oak Ridge National Lab., TN (USA); Princeton Univ., NJ (USA). Plasma Physics Lab.). 1983. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000957.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

Tritium pellet injection into neutral deuterium, beam heated deuterium plasmas in the Tokamak Fusion Test Reactor (TFTR) is shown to be an attractive means of (1) minimizing tritium use per tritium discharge and over a sequence of tritium discharges; (2) greatly reducing the tritium load in the walls, limiters, getters, and cryopanels; (3) maintaining or improving instantaneous neutron production (Q); (4) reducing or eliminating deuterium-tritium (D-T) neutron production in non-optimized discharges; and (5) generally adding flexibility to the experimental sequences leading to optimal Q operation. Transport analyses of both compression and full-bore TFTR plasmas are used to support the above observations and to provide the basis for a proposed eight-pellet gas gun injector for the 1986 tritium experiments.

51025 **(CONF-831203—180) Impact of maximum TF magnetic field on performance and cost of an advanced physics tokamak.** Reid, R.L. (Oak Ridge National Lab., TN (USA)). 1983. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000953.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

Parametric studies were conducted using the Fusion Engineering Design Center (FEDC) Tokamak Systems Code to investigate the impact of variation in the maximum value of the field at the toroidal field (TF) coils on the performance and cost of a low q/sub psi/, quasi-steady-state tokamak. Marginal ignition, inductive current startup plus 100 s of inductive burn, and a constant value of epsilon (inverse aspect ratio) times beta poloidal were global conditions imposed on this study. A maximum TF field of approximately 10 T was found to be appropriate for this device.

51026 **(CONF-840534—3) Plasma surface interaction processes and possible synergisms.** Behrisch, R.; Roberto, J.B. (Oak Ridge National Lab., TN (USA); Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Aug 1984. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001861.

From Workshop on synergistic effects in surface phenomena related to plasma-wall interactions; Nagoya, Japan (21 May 1984).

The process determining the plasma surface interaction in today's high temperature plasma experiments are investigated following several lines. First, in plasma devices, the particle and energy fluxes to the different first wall areas the fluxes from the walls back into the plasma are measured and the boundary plasma parameters are determined. The surface composition and structure of the walls, limiters and divertor plates are analyzed following exposure to many discharges. Secondly, the different surface processes which are expected to contribute to the plasma surface interaction (particularly to hydrogen particle balance and impurity introduction) are studied in simulation experiments using well defined particle beams.

51027 **(CONF-840915—3) Design and fabrication of a beryllium limiter for ISX-B.** Edmonds, P.H.; Watson, R.D.; Smith, M.F. (Oak Ridge National Lab., TN (USA); Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789;AC05-84OR21400. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84017331.

From 13. symposium on fusion technology; Varese, Italy (24 Sep 1984).

A movable, temperature-controlled, beryllium rail limiter has been used in the Impurity Study Experiment (ISX-B) tokamak at the Oak Ridge National Laboratory (ORNL). The purpose of the experiment was to evaluate the suitability of the material for installation on the Joint European Torus (JET) experiment. The limiter was designed for a surface temperature rise of 600°C for each tokamak shot. This rise corresponds to a heat flux to the limiter surface of approximately 2.1 to 2.4 kW/cm^2 for 0.3 s. The experimental test

was expected to require a lifetime of approximately 3000 neutral beam-heated plasma discharges to meet the planned surface fluence of 10^{22} hydrogen ions per cm^2. A temperature control system was used to maintain the base-plate temperature of the limiter at about 200°C. Normal plasma radius was 24 cm. The experimental results indicate that the beryllium limiter functions normally unless brought to melting point, when evaporated beryllium covers the liner walls, gettering the discharge. Under these conditions beryllium was the dominant impurity.

51028 **(CONF-840937—3) Experience highlights from the design and manufacture of US LCT coils.** Kibbe, R.K.; Amonett, C.M.; Benson, R.D.; Hussung, R.O.; Shipley, W.D. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017504.

From Applied superconductivity conference; San Diego, CA, USA (9 Sep 1984).

The international Large Coil Task (LCT) is a major activity in the development of superconducting toroidal field (TF) coils for tokamak fusion reactors. The technical objective of this program is to design, build, and test six large TF coils, thereby producing information and data that can be used directly by program planners and designers of tokamak reactors. After an intensive competitive bidding cycle, contracts were awarded in 1977 to three US industrial firms for the design and manufacture of test coils. Subsequently Japan, EURATOM, and Switzerland agreed to supply one coil each. External dimensions and minimum performance requirements are identical but freedom was allowed in the choice of internal design and manufacturing techniques. All six coils will be tested in a compact toroidal array in the Large Coil Test Facility (LCTF) in Oak Ridge, Tennessee. With the coil fabrication phase approaching completion, it is an appropriate time to review the major technical challenges and lessons from the design and manufacture of the three US LCT coils.

51029 **(CONF-840937—4-Draft) Preliminary results of the partial array LCT coil tests.** Luton, J.N.; Cogswell, F.D.; Dresner, L.; Friesinger, G.M.; Gray, W.H.; Iwasa, Y.; Koizumi, K.; Lubell, M.S.; Lue, J.W.; Nishi, M.F. (Oak Ridge National Lab., TN (USA); Massachusetts Inst. of Tech., Cambridge (USA); Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.); Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment; General Dynamics Corp., San Diego, CA (USA). Convair Div.; Schweizerisches Inst. fuer Nuklearforschung, Villigen). 10 Sep 1984. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001610.

From Applied superconductivity conference; San Diego, CA, USA (9 Sep 1984).

The Large Coil Task (LCT) is a collaboration between the US, Euratom, Japan, and Switzerland for the production and testing of 2.5 x 3.5-m bore, superconducting 8-T magnets. The definitive tests in the design configuration, the six coils arrayed in a compact torus, will begin in 1985. Partial-array tests are being done in 1984. In January the initial cooldown of two coils was aborted because of helium-to-vacuum leaks that developed in certain seal welds when the coil temperatures were 170 to 180 K. In July three adjacent coils (designated JA, GD, CH) were cooled and in August two were energized to the limits of the test facility. An overview of the results are presented, including facility, cooldown (warmup has not yet begun), energization, dump, recovery from intentional normal zones, strain, and displacement, for operation up to 100% of design current but below full field and stress. These initial results are highly encouraging.

51030 **(CONF-840937—5) Subcable test facility.** Kim, S.H. (Argonne National Lab., IL (USA)). Sep 1984. Contract W-31-109-ENG-38. 3p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002103.

From Applied superconductivity conference; San Diego, CA, USA (9 Sep 1984).

A subcable test facility was prepared to study ac losses and stability of subsize cables under the pulsing magnetic field of a 40-kJ split-pair coil. A G-10 cryostat fabricated for the system has an inner diameter of 31 cm and is 170 cm deep. An 80-kW power supply for the coil has a pulsing mode of triangular operation. Another 500-kW power supply, rated for dc operation at 400 V and 1250 A, can have pulsing modes of triangular, trapezoidal, or (B + B) superimposed. AC losses of a superconducting composite strand with CuNi outer sheath were measured. Coupling losses among the strands were not significant because of the outer sheath.

51031 **(CONF-840937—6) Computer simulation of multiple stability regions in an internally cooled superconducting conductor and of helium replenishment in a bath-cooled conductor.** Turner, L.R.; Shindler, J. (Argonne National Lab., IL (USA)). Sep 1984. Contract W-31-109-ENG-38. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002112.

From Applied superconductivity conference; San Diego, CA, USA (9 Sep 1984).

For upcoming fusion experiments and future fusion reactors, superconducting magnetic have been chosen or considered which employ cooling by pool-boiling HeI, by HeII, and by internally flowing HeI. The choice of conductor and cooling method should be determined in part by the response of the magnet to sudden localized heat pulses of various magnitudes. The paper describes the successful computer simulation of multiple stability in internally cooled conductors, as observed experimentally, using the computer code SSICC. It also describes the modeling of helium replenishment in the cooling channels of a bath-cooled conductor, using the computer code TASS.

51032 **(DOE/DP/40183—1) Wet wall cavity response in ICF reactors.** Peterson, R.R. (Wisconsin Univ., Madison (USA). Dept. of Nuclear Engineering). Jun 1984. Contract AS08-83DP40183. 35p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84017451.

The work reported here has examined four general issues: (1) bare first wall survival for high density cavities; (2) liquid metal vaporization and recondensation and the resultant maximum allowable repetition rate for microexplosions; (3) stability of liquid metal layer under the influence of vaporization; and (4) leakage of target chamber material through the beam ports. The first item was done because there is the possibility that heavy ion beams can be propagated through 1 to 10 torr (0°C) of cavity gas and if this is possible, the gas may sufficiently protect the wall from the target energy so that the liquid metal protection is not necessary.

51033 **(KFK—3680) TASKA-M - a low cost, near term tandem mirror device for fusion technology testing.** Badger, B.; Corradini, M.L.; El-Guebaly, L.; Emmert, G.A.; Kulcinski, G.L.; Larsen, E.M.; Maynard, C.W.; Perkins, L.J.; Peterson, R.R.; Plute, K.E. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Kernfusion). Apr 1984. 596p. (FPA—83-7; UWFDM—600). NTIS (US Sales Only), PC A25/MF A01. File Number DE84752167.

TASKA-M (Modifizierte Tandem Spiegelmaschine Karlsruhe) is a study of a dedicated fusion technology device based on the mirror principle, in continuation of the 1981/82 TASKA study. The main objective is to minimize cost while retaining key requirements of neutron flux and fluence for blanket and material development and for component testing in a nuclear environment. Direct costs are reduced to about 400 M$ by dropping reactor-relevant aspects not essential to technology testing: No thermal barrier and electrostatic plugging of the plasma; fusion power of 7 MW at an injected power of 44 MW; tritium supply from external sources. All technologies for operating the machine are expected to be available by 1990; the plasma physics relies on microstabilization in a sloshing ion population.

51034 **(KFK—3705) INTOR phase IIA, magnet system design - European contribution.** Arendt, F.; Becker, F.; Dittrich, H.G.; Erb, J.; Fluekiger, R.; Jeske, U.; Komarek, P.; Manes, B.; Nyilas, G.; Hilal, M. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Technische Physik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Kernfusion). Mar 1984. 119p. NTIS (US Sales Only), PC A06/MF A01. File Number DE84752169.

The INTOR TF magnet has been designed as a two zone winding in a casing with thin side walls at the central region. Two integrated wedging cylinders are formed by the circumferential ribs at the inner leg. In the low field zone up to 7.6 T the LCP NbTi-Euratom conductor has been taken. For the high field part of the winding up to 11 T a Nb_3Sn up-grade version of the Euratom-LCP conductor has been designed with 20 kA conductor current. Supercritical forced flow cooling has been forseen for both conductors. For comparison with this KfK study the TF-conductor designs of the SULTAN-group (ECN, ENEA, SIN) and the alternative TF coil structure of SIN are included in this report. The PF magnet design was based on a 50 kA bath cooled conductor proposed by JAERI (which reflects the situation, that ITP has just started a PF conductor development). All PF coils are located outside the TF coils. The coil cross sections were evaluated and at least the outer 24 m diameter EF-coil needs a subdivision. For all PF coils the NbTi-technology appeared to be applicable as the induction at the conductors did not exceed 8.4 T.

51035 **(ORNL/Sub—79-21453/18) 60 GHz Gyrotron Development Program. Quarterly report No. 18, October-December 1983.** Jory, H.R.; Bier, R.E.; Craig, L.J.; Felch, K.L.; Fox, L.J.; Lopez, N.; Huey, H.E.; Manca, J.; Spang, S.T. (Varian Associates, Inc., Palo Alto, CA (USA)). 1983. Contract AC05-84OR21400. 50p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85000340.

The objective of this program is to develop a microwave oscillator capable of producing 200 kW of CW power at 60 GHz with high purity of the output mode. Power density measurements on the extended 2-1/2 in. collector used in X-8 showed that better magnetic spreading of the beam is necessary to make it a reliable CW collector. This collector was shown to have excellent output mode purity. Work continued on a low-power-density, low-mode-conversion 4 in. collector with satisfactory results. The double-disc window was tested successfully in relatively pure mode TE_{02} at CW power levels up to 76 kW.

51036 **(UCID—20166-Vol.1) Special topics reports for the reference tandem mirror fusion breeder: liquid metal MHD pressure drop effects in the packed bed blanket. Vol. 1.** McCarville, T.J.; Berwald, D.H.; Wong, C.P.C. (TRW Energy Development Group, Redondo Beach, CA (USA); GA Technologies, Inc., San Diego, CA (USA)). Sep 1984. Contract W-7405-ENG-48. 44p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85002142.

Magnetohydrodynamic (MHD) effects which result from the use of liquid metal coolants in magnetic fusion reactors include the modification of flow profiles (including the suppression of turbulence) and increases in the primary loop pressure drop and the hydrostatic pressure at the first wall of the blanket. In the reference fission-suppressed tandem mirror fusion breeder design concept, flow profile modification is a relatively minor concern, but the MHD pressure drop in flowing the liquid lithium coolant through an annular packed bed of beryllium/thorium pebbles is directly related to the required first wall structure thickness. As such, it is a major concern which directly impacts fissile breeding efficiency. Consequently, an improved model for the packed bed pressure drop has been developed. By considering spacial averages of electric fields, currents, and fluid flow velocities the general equations have been reduced to simple expressions for the pressure drop. The averaging approach results in expressions for the pressure drop involving a constant which reflects details of the flow around the pebbles. Such details are difficult to assess analytically, and the constant may eventually have to be evaluated by experiment. However, an energy approach has been used in this study to bound the possible values of the constant, and thus the pressure drop. In anticipation that an experimental facility might be established to evaluate the undetermined constant as well as to address other uncertainties, a survey of existing facilities is presented.

51037 **(UCRL—90666) Performance of the Cascade inertial-confinement-fusion conceptual reactor.** Pitts, J.H. (Lawrence Livermore National Lab., CA (USA)). 18 Sep 1984. Contract W-7405-ENG-48. 9p. (CONF-840915—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017568.

From 13. symposium on fusion technology; Varese, Italy (24 Sep 1984).

A 4.5-m-radius rotating fusion reactor made of silicon carbide and containing a moving 1-m-thick lithium-ceramic granular blanket can produce 3000 MW/sub t/. The blanket operates at high temperature (>1200 K) leading to gross plant efficiencies of up to 60% using a combined helium-gas turbine (Brayton cycle) with a vapor bottoming cycle.

51038 **(UCRL—91512) Evolution of the mirror approach to fusion: some conjectures.** Post, R.E. (Lawrence Livermore National Lab., CA (USA)). 18 Sep 1984. Contract W-7405-ENG-48. 61p. (CONF-840932—1). NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE84017570.

From Meeting on plasma physics; Trieste, Italy (24 Sep 1984).

Some possible directions for the future evolution of the mirror approach to fusion are outlined, in the context of economically-motivated criteria. Speculations are given as to the potential advantages, economic and otherwise, of the use of axially-symmetric systems, operated in semi-collisional regimes of lower Q (fusion power balance ratio) than that projected for present-day tandem mirror designs. These regims include barely tandem modes, and ion-heated modes, in association with higher efficiency direct conversion. Another possible economically advantageous approach mentioned is the use of a tandem mirror plasma to stabilize a FRM (field-reversed mirror) plasma, with potential synergistic advantages.

51039 **Insulation systems engineering.** Becker, H.; Marston, P.G. (Massachusetts Institute of Technology, Cambridge (U.S.A.)). *Journal de Physique (Paris), Colloque;* **45**: 615-618(Jan 1984). (CONF-830971—).

From 8. international conference on magnet technology and exhibition; Grenoble, France (5 Sep 1983).

With careful attention to engineering detail design, it is possible to take advantage of high strength organic insulators to design more efficient fusion magnet insulation systems. By optimizing insulator/magnet design through maximum use of thin sheet mechanical properties, it may also be possible to operate at a higher radiation fluence level with additional economic payoff in reduced magnet size and cost.

51040 **Failure of a large cryogenic MHD magnet.** Becker, H.; Tarrh, J.M.; Marston, P.G. (Massachusetts Institute of Technology, Cambridge (U.S.A.)). *Journal de Physique (Paris), Colloque;* **45**: 603-606(Jan 1984). (CONF-830971—).

From 8. international conference on magnet technology and exhibition; Grenoble, France (5 Sep 1983).

In December of 1982 the MHD magnet (designed to achieve 6 T over an active bore approximately 1 m square x 7 long) for the High Performance Demonstration Experiment HPDE suffered a catastrophic structural failure, which induced massive brittle fracture. The authors have completed an autopsy and analysis, and have determined the cause of failure.

51041 **Magnet failure workshop.** Marston, P.G. (Massachusetts Institute of Technology, Cambridge (U.S.A.)); Desportes, H. (C.E.N.-Saclay, 91 - Gif-sur-Yvette (France)); Morpurgo, M. (C.E.R.N., Geneva (Switzerland)); Komarek, P. (Kernforschungszentrum, Karlsruhe (Germany, FR)); Van Hulst, K. (University of Nijmegen (The Netherlands)); Hackley, D. (General Dynamics Convair, San Diego, CA (U.S.A.)); Young, J.L. (Westinghouse Electric Corporation, East Pittsburgh, PE (U.S.A.)); Kibbe, K. (Oak Ridge National Laboratory (U.S.A.)). *Journal de Physique (Paris), Colloque;* **45**: 637-642(Jan 1984). (CONF-830971—).

From 8. international conference on magnet technology and exhibition; Grenoble, France (5 Sep 1983).

The dictionary defines failure as nonperformance or an unacceptable want of success. (The definition implies that the results should have been avoided). In an emerging technology such as ours, the boundaries of expectations and "unacceptable success" are often ill defined. Failures are often touted as hugh successes (occasionally rightfully so) and exceptional technological achievement can become dismal failure (if expectations are too high). We all, however, have experienced problems of one sort or another and the

basic purpose of the workshop was simply to communicate these so that new or future workers don't make the same mistakes.

51042 **Analytical studies of advanced high-field designs: 20-Tesla large bore superconducting magnets.** Hoard, R.W.; Cornish, D.N.; Scanlan, R.M.; Zbasnik, J.P.; Leber, R.L.; Hickman, R.B.; Lee, J.D. (University of California, Livermore (U.S.A.)). *Journal de Physique (Paris), Colloque;* **45**: 875-880(Jan 1984). (CONF-830971—).

From 8. international conference on magnet technology and exhibition; Grenoble, France (5 Sep 1983).

Several emerging technologies have been combined in a conceptual design study demonstrating the feasibility of producing ultrahigh magnetic fields from large-bore superconducting solenoid magnets. Several designs have been produced that approach peak fields of 20-T in 2.0-m diameter inner bores. The analytical expressions comprising the main features of CONDUCTOR and ADVMAGNET, the two computer programs used in the design of these advanced magnets, are also discussed. These magnets and design techniques will make a paramount contribution to the national mirror-fusion endeavour and to the newly emerging field of nuclear magnetic resonance (NMR) whole-body scanners.

51043 **Fusion reactor studies at Argonne National Laboratory. Present status of fusion researches in USA, (2).** Jung, J.; Baker, C.C. (Argonne National Lab., IL). *Nippon Genshiryoku Gakkaishi;* **25**: No. 7, 505-512(Jul 1983). (In Japanese).

The research on the nuclear fusion reactors based on the magnetic field containment method in USA is fundamentally concentrated on two representative types, that is, takamak type torus method and tandem mirror type open end method. The research on nuclear fusion reactors in the ANL has been performed solely on the tokamak type reactors, and emphasis has been placed on the nuclear design of the reactors. The ANL is composed of the main site and the Idaho site, and it has been operated by the University of Chicago for the Department of Energy. About 4200 persons work, and the yearly budget is 230 million dollars. The Fusion Power Program is in the main site, and the staffs of about 80 engage in it. It is operated with the yearly budget of about 7.2 million dollars. The research activities are roughly classified into five fields, that is, the system analysis and design of nuclear fusion reactors, blanket and shield engineering, the properties of materials, superconducting magnets and energy storage, and the interaction with universities and industries. The researches on the STARFIRE reactor, the alternate fuel cycle, the radioactivation of nuclear fusion reactors, FW/B/S program, and the comparison and selection of blankets are reported.

51044 **Heating and cooling systems for JT-60 Vacuum Vessel.** Kajiura, S.; Hata, M.; Koda, T.; Nakamura, H.; Sato, K.; Shimizu, M.; Shimizu, T. (Hitachi Ltd.). pp 983-987 of Fusion engineering. Vol. 2. New York, NY, USA; I.E.E.E. (1983). (CONF-831203—).

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

The structure and the test results of JT-60 heating and cooling systems are described. The heating system consists of electric heaters, thermocouples and thermal insulation, and the cooling system consists of square cooling tubes. These components are mounted on the vacuum vessel to satisfy the design conditions. Heating and cooling of the vessel are controlled by a machine control system. Heating and cooling tests of 180° sectorial vacuum vessel have been performed, in which it was heated up from R.T. to 500°C within 70 hrs and cooled down from 500°C to 80°C within 60 hrs. It is concluded from the test results that JT-60 heating and cooling systems is effective.

99 GENERAL AND MISCELLANEOUS

51045 **(N—84-25588) Nonaerospace uses of JPL technology: a report on technology transfer.** (Jet Propulsion Lab., Pasadena, CA (USA)). Sep 1983. 32p. (NASA-CR—172804; JPL—400-205). NTIS, PC A03/MF A01.

This report examines various nonaerospace applications of JPL technology. JPL has developed and applied a number of models for the effective transfer of space technology to uses in the public and private sector. Successful technology transfers were achieved in the following areas: chromosome analysis mass spectrometry manufacturing cost prediction gas detection by lasers blood substitutes ultrasound imaging composite materials and detonation and flame arresters.

9901 Management

51046 **(DOE/IG—0212) Department-wide review of advance financing by letter of credit.** Richards, J.R. (USDOE Office of Inspector General, Washington, DC). 17 Oct 1984. 27p. TIC, PO Bx 62, Oak Ridge, TN 37831. File Number TI85000909.

Report to The Secretary.

The ten Department locations included in the review had generally established a need for advance financing and met the minimum requirements for letters of credit (LOC). In addition we found that a number of management improvements had been made since a similar review by the Inspector General in 1981 (Report No. DOE/IG-0152, dated April 6, 1981). However, some refinements of LOC management practices and procedures were necessary to optimize Department and recipient LOC management. Recipient and banking agreements did not always contain all of the requirements established in Government cash management procedures. Consequently, in those instances the Department's control of its funds was decreased and recoupment of interest cost for excess federal cash held by recipients was precluded, in many cases. Several areas regarding the monitoring of LOC related activities required further management attention. Because of lax monitoring practices, instances of inadequate reporting and other reported problems were not corrected; earned interest was not returned to the Treasury; and ineffective drawdown practices were allowed to continue. Consequently, interest costs to the Government were increased significantly. Competition for the procurement of banking services for checks-paid LOCs was sometimes too restrictive and not adequately managed. Thus, the Department could not be sure it was obtaining the most economical banking rates available. Recommendations are included.

51047 **(UCRL—53564) Report of the Long-Range Planning Committee.** (Lawrence Livermore National Lab., CA (USA)). 1 Jul 1984. Contract W-7405-ENG-48. 35p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85001936.

This is the final report of the Long-Range Planning Committee of the Lawrence Livermore National Laboratory. It describes the make-up, purpose, working assumptions, and activities of the Committee and discusses the work done by the Committee on defense matters, energy, a number of additional topics, and future long-range planning activities.

9902 Mathematics And Computers

REFER ALSO TO CITATION(S) 99020050374, 50375, 50376, 50377, 50378, 50379, 50380, 50381

51048 **(ANL—84-63) Accuracy of the finite analytic method for scalar transport calculations.** Vanka, S.P. (Argonne National Lab., IL (USA)). Sep 1984. Contract W-31-109-ENG-38. 25p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001474.

The accuracy of the finite analytic method of discretizing fluid flow equations is assessed through calculations of multidimensional scalar transport. The transport of a scalar function in a uniform velocity flow field inclined with the finite-difference grid lines is calculated for a range of grid Peclet numbers and flow skewness. The finite analytic method is observed to be superior to the approach of constructing finite-difference analogs from locally one-dimensional resolution of the flow vector. However, the finite analytic method also produces appreciable errors locally in regions of steep variations, under conditions of large grid Peclet numbers, and skewness of the streamlines.

51049 **(ANL/TM—404-Rev.) Guide to personal desktop computing at ANL.** Coultis, D.; Gallo, M.; Lusk, E.; Moszur, F. (Argonne National Lab., IL (USA)). Sep 1984. Contract W-31-109-ENG-38. 107p. NTIS, PC A06/MF A01; GPO Dep. File Number DE85001438.

Guide to Personal Desktop Computing at ANL, ANL/TM 404, discusses personal desktop computers in general and in the context of the larger scheme of computing tools and services at the Laboratory. This revision of the document provides updated information and recommendations to assist users in meeting their computing needs. It outlines services for personal desktop computer users at Argonne and covers technological changes in personal desktop computer hardware and software since the original publication of this document in April 1983.

51050 **(CONF-8409147—1) Recent advances in data compression.** Liepins, G.E. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001133.

From 20. annual meeting of the Southeastern Chapter of the Institute of Management Sciences; Myrtle Beach, SC, USA (27 Sep 1984).

Data compression is the art of succinct data representation. Compression techniques can be characterized variously including, for example, the degree of compression and fidelity. For example, compression techniques used to speed data I/O in computer systems must have total fidelity, whereas those used to transmit visual images may be information lossy. For any data source and given level of acceptable distortion (information loss), Shannon's classical work establishes the fundamental limits for compression; no compression method can exceed the compression given by the fundamental limit. For total fidelity compression, general consensus is that additional research will result in no more than marginal improvements in compression ratio. In contrast, for information lossy methods, there appears to be room for improvement. The most promising current information lossy methods seem to be variants of pattern matching and pattern recognition, and research on these areas promises to have applications to computer assisted design (CAD) and artificial intelligence.

51051 **(EGG-EA—6703) User's guide to MIX: a computer code for fitting mixture distributions to data.** Atwood, C.L. (EG and G Idaho, Inc., Idaho Falls (USA)). Sep 1984. Contract AC07-76ID01570. 25p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001451.

Rather than fitting data by a simple model, such as a normal, Poisson, or negative binomial distribution, it may be preferable to use a mixture of such distributions. Methods for choosing a mixture model that fits the data well are presented and discussed. Then the computer code MIX is presented; all the commands are explained, to carry out the methods discussed earlier; use of MIX on the INEL Cyber is described; and a sample job is given.

51052 **(INER—0503) Coefficients determination of differential state equations from Laplace transfer function.** Wang, C.Y. (Institute of Nuclear Energy Research, Lung-Tan (Taiwan). Technical Information Center). Apr 1983. 28p. (In Chinese). NTIS (US Sales Only), PC A03/MF A01. File Number DE85900141.

In control theory, the characteristics of a system are generally described or defined by Laplace transfer function. However, the state variable differential equations are generally used in the actual system simulation on hybrid computer or general digital computer. In this way, the differential equations are integrated to get the result. So, the first thing in system simulation is to translate the Laplace transfer function into the state variable differential equations. The primary object of this article is to develop a computer program to do this job as well as scale the coefficient of each state variable through interactive communication with computer on a terminal.

51053 (INIS-SU—247, pp 231-234) **Automatic system of scientific investigations for nuclear analysis.** Ovcharov, A.M.; Chernov, I.P. 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. File Number TI84780555. (CONF-8205270—).

From 12. All-Union conference on physics of interaction between charged particles and crystals; Moscow, USSR (25 May 1982).

The automatic system of scientific investigations (ASSI) developed in the ASSI Institute of Nuclear Analysis, is considered. The system permits choice of optimum conditions for experimentation and to interpret results of measurements. A net of mutual mini- and micro-computer family "Electronika" is taken as a basis. The connection with additional peripheral devices and experimental devices is made by KAMAK-equipment.

51054 (INIS-SU—247, pp 94-100) **Data processing with small statistics by Fourier analysis.** Pokhil, G.P.; Chumanova, O.V. 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. File Number TI84780555. (CONF-8205270—).

From 12. All-Union conference on physics of interaction between charged particles and crystals; Moscow, USSR (25 May 1982).

A method of determining the multinominal order $Fn(x)=A_0/2+\Sigma$ asub(i) cosi $\omega x+\Sigma$ bisin $i\omega x$, is considered with the aim of levelling curves in the experiment with small statistics, on the determination of time for nuclear reaction from the analysis of depth measurement of the shadow picture. The universal nature of the method relatively to the curve described is noted due to the fact that no concrete trial function is necessary beforehand. The number of parameters sufficient for the description of experimental corve by the multinominal ($<= 5$) is much less than in the case of using the description with the aid of the trial function, e.g. the distribution sum of the Gauss type.

51055 **(Juel-Spez—208) Analytical model for an input/output-subsystem.** Roemgens, J. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Zentralinstitut fuer Angewandte Mathematik; Technische Hochschule Aachen (Germany, F.R.)). May 1983. 116p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE84751527.

An input/output-subsystem of one or several computers if formed by the external memory units and the peripheral units of a computer system. For these subsystems mathematical models are established, taking into account the special properties of the I/O-subsystems, in order to avoid planning errors and to allow for predictions of the capacity of such systems. Here an analytical model is presented for the magnetic discs of a I/O-subsystem, using analytical methods for the individual waiting queues or waiting queue networks. Only I/O-subsystems of IBM-computer configurations are considered, which can be controlled by the MVS operating system. After a description of the hardware and software components of these I/O-systems, possible solutions from the literature are presented and discussed with respect to their applicability in IBM-I/O-subsystems. Based on these models a special scheme is developed which combines the advantages of the literature models and avoids the disadvantages in part.

51056 **(LBL—18246) Portable, public domain LEX for the Software Tools.** Paxson, V. (Lawrence Berkeley Lab., CA (USA)). Jun 1984. Contract AC03-76SF00098. 11p. (CONF-8406202—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000703.

From USENIX Association and Software Tools User Group summer conference; Salt Lake City, UT, USA (12 Jun 1984).

Chances are you are writing a lot of your programs the hard way. You can write smaller, more efficient programs with less effort by using the portable Software Tools Lex. This paper describes how to use Lex and why programs generated with it give excellent performance.

51057 **(LBL-PUB—3045) Introduction to LBL graphics.** (Lawrence Berkeley Lab., CA (USA)). Aug 1984. Contract AC03-76SF00098. 244p. NTIS, PC A11/MF A01; 1; GPO Dep. File Number DE85000389.

The Computing Services Department supports a number of graphics software packages on the VAX machines, primarily on the IGM VAX. These packages will drive a large variety of different graphical devices, terminals (including various Tektronix terminals, the AED 512 color raster terminal, the IMLAC Series II vector list

processor terminal and others), various styles of plotters and the DICOMED D48 film recorder. We are going to present to you the following graphic software packages: Tell-A-Graf, Cuechart, Tell-A-Plan, Data Connection, DI-3000, Contouring, Grafmaker (including Grafeasy), Grafmaster, Movie.BYU, Grafpac, IDDS, UGS/HPLOT/HBOOK, and SDL/SGL.

51058 **(ORNL/TM—9250) Beginner's guide to blocked records on magnetic tape.** Kirk, B.L. (Oak Ridge National Lab., TN (USA)). Sep 1984. Contract AC05-84OR21400. 57p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85001691.

The subject of this report is the usage of magnetic tape for data storage. The appendix listings are intended to guide users in choosing the best possible parameters when blocking data of record lengths 80 or 133 bytes. Only fixed block records are of interest here. The formulas listed in the report are also applicable to records having varied lengths. The use of 80 and 133 is dictated by their popularity.

51059 **(PNL-SA—12457) Role of environments in managing data analysis.** Nicholson, W.L.; Carr, D.B.; Cowley, P.J.; Whiting, M.A. (Pacific Northwest Lab., Richland, WA (USA)). May 1984. Contract AC06-76RL01830. 12p. (CONF-840849—5). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000397.

From Annual meeting of the American Statistical Association (ASA); Philadelphia, PA, USA (12 Aug 1984).

Data analysis is a clue-driven process which evolves as a network of analysis paths, some fruitful and some unproductive. Data analysis environments as entities and associated interactive software provide the data analyst with tools for effective management of the process. The analyst may save the state of the process at any point of the network as a data analysis environment. Environments may be restored to review previous results, verify what was done, or to continue the analysis. Other functions provide detailed information about the analysis including displays of accessible data and lists of previously traversed analysis paths. This paper describes the maintenance and capture of data and auxiliary information as environments and the interaction of the analyst with the environments.

51060 **(PNL-SA—12474) Organizational tools for data analysis environments.** Carr, D.B.; Cowley, P.J.; Whiting, M.A.; Nicholson, W.L. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1984. Contract AC06-76RL01830. 13p. (CONF-840849—6). NTIS, PC A02/MF A01; GPO Dep. File Number DE85000396.

From Annual meeting of the American Statistical Association (ASA); Philadelphia, PA, USA (12 Aug 1984).

This paper describes organizational tools and graphical interaction displays that are used to assist in data analysis. The graphical displays depict the hierarchical relationship among saved states from data analysis sessions as a tree. Each node on the tree represents a data analysis environment, which includes icons that indicate availability of plots and annotations, textual descriptions, and oral descriptions on cassette tape. A graphics work pad is used to select a data analysis environment from which the analysis is to proceed. Menus and information windows provide assistance in reviewing the analysis tree, input and retrieval of annotations, and the creation and retrieval of environments.

51061 **(SAND—84-0847) Three-dimensional model for a porous elastic anisotropic solid with inclusions, taking into account dissipation, heat flux, radiation and thermal stress.** Passman, S.L.; Batra, R.C. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1984. Contract AC04-76DP00789. 41p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85001948.

A number of applications arise where a porous solid body with inclusions is subjected to large stresses and the influence of heat transfer, both by conduction and by radiation. Often, such a body is anisotropic either because of its method of manufacture, or in the case of geological materials, because of its method of formation. Though a priori, empirical, and semi-empirical models and partial models for such materials are commonly used in engineering calculations, no three-dimensional model exists which takes all of these phenomena into account, and also has been shown to be in accord with all of the accepted principles for formulating constitutive equations. The basic principles we use are straightforward applications of techniques of rational mechanics, most developed many years ago, but some settled only quite recently, and principally as a result of research done at Sandia National Laboratories. Since the problem we consider is intrinsically complicated, it is no surprise that the equations are complicated also. However, we do attempt to formulate the model with the greatest economy of formalism consistent with our goals. Since we are dealing with a material composed of more than one constituent, we use a mixture theory. The constituent of primary interest is a porous hyperelastic solid, which we allow to undergo finite deformations. The other constituent is a dissipative material which we envision as filling part of the pore space in the elastic material. The rest of the pore space is treated as vacuous, though we allow for pore crushing through a dissipative mechanism.

51062 **(SOL—84-6) User's guide for QPSOL (Version 3.2): a Fortran package for quadratic programming.** Gill, P.E.; Murray, W.; Saunders, M.A.; Wright, M.H. (Stanford Univ., CA (USA). Systems Optimization Lab.). Sep 1984. Contract AT03-76ER72018. 40p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85001557.

This report forms the user's guide for Version 3.2 of QPSOL, a set of Fortran subroutines designed to locate the minimum value of a quadratic function subject to linear constraints and simple upper and lower bounds. If the quadratic function is convex, a global minimum is found; otherwise, a local minimum is found. The method used is most efficient when many constraints or bounds are active at the solution. QPSOL treats the Hessian and general constraints as dense matrices, and hence is not intended for large sparse problems.

9903 Information Handling

51063 **(UCRL—91383) Integration of an automated library support system with an intelligent gateway.** Burton, H.D. (Lawrence Livermore National Lab., CA (USA)). Aug 1984. Contract W-7405-ENG-48. 10p. (CONF-8409138—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85001741.

From Integrated online library systems conference; Atlanta, GA, USA (13 Sep 1984).

A new project of the Technology Information System (TIS) at the Lawrence Livermore National Laboratory (LLNL) calls for the evaluation of commercially available library support packages and the extension and integration of the most desirable system with the TIS gateway to provide a comprehensive prototype for libraries and information centers. This prototype system is planned to facilitate access to and management of in-house activities such as cataloging, serials control, and acquisitions, as well as to interface to external systems and services for data downloading and exchange, retrieval, and post-processing. Cooperative cataloging, distributed database processing, electronic inter-library loan, and customized bibliography production are some of the features planned for the prototype. Development of a user-friendly front-end processor will allow the user to negotiate his search query in a semi-automated manner using a single, English-like command language. The TIS at Lawrence Livermore National Laboratory (LLNL) has developed a computer-based intelligent gateway for automated access to such diverse, geographically distributed information systems as DOE/RECON, DOD/DROLS, NASA/RECON, CAS On-Line, DARC (France) and DECHEMA (West Germany), among many others. New information resources centers are being added as required and users can connect simultaneously to more than one host to compare their data. The TIS online master directory provides the user with a single, integrated view of available and relevant resources. The automated access procedures permit the user to concentrate on the information aspects of his work rather than be burdened with various log-on procedures, database formats and protocols. The merger of the library support with the TIS gateway should provide users with a capabilities to access and utilize the full spectrum of textual, numeric and graphics data resources.

CORPORATE AUTHOR INDEX

In the Corporate Index, report literature is indexed using the name of the organization or institution responsible for issuing the report. Headings are provided for all report literature and for published literature for which a corporate approach is especially desirable, e.g., symposium and conference proceedings.

Each entry under a corporate heading gives the document title and the volume and abstract numbers. The document type, e.g., R for Report; country of publication, e.g., US; and language of the document, e.g., In German; are given in parentheses at the end of the entry. If no language statement appears, the language is English. Tables of document types and country of publication codes appear after the indexes.

DOE Energy Information Data Base: Corporate Author Entries (DOE/TIC-4585) is used in the standardization of corporate entries. DOE/TIC-4585 is available for purchase from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, Virginia 22161.

A

Academia Sinica, Beijing (China). Inst. of Electronics
Multimode harmonic power measurement of 40 MW pulsed S-band klystrons, 9:50464 (R;US)

Acurex Corp., Mountain View, CA (USA). Energy and Environmental Div.
Testing and evaluation of on-farm alcohol production facilities. Final report, 9:49585 (R;US)

Advanced Energy Dynamics, Inc., Natick, MA (USA)
Pilot Plant Program for the AED Advanced Coal Cleaning System. Phase II. Interim final report, 9:49423 (R;US)

Aeronautical Research Labs., Melbourne (Australia)
Acceleration and confinement of energetic particles in the 7 June 1980 solar flare, 9:50687 (R;AU)

Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering
BRIK, an interactive, goal programming model for nuclear exchange problems. Master's thesis, 9:50508 (R;US)
Investigation of optimal aimpoints for multiple nuclear weapons against installations in a target complex. Master's thesis, 9:50507 (R;US)

Air Force Systems Command, Wright-Patterson AFB, OH (USA)
Method to estimate the vertical dispersion parameter in a 10 Km range, 9:50514 (R;US)

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Alabama Univ., Birmingham (USA)
Ion implantation of surgical Ti-6Al-4V alloy, 9:50590 (R;US)

Allen (Eliot) and Associates, Inc., Salem, OR (USA)
Solar access protection: executive summaries of the 1981-1982 Bonneville Power financial assistance grants to local governments, 9:49601 (R;US)

Altas Corp., Santa Cruz, CA (USA)
Proceedings: eighth annual geothermal conference and workshop, 9:49721 (R;US)

Amax Extractive R and D, Inc., Golden, CO (USA)
Ultra-fine coal characterization. 2nd quarterly report, June 1, 1984-August 31, 1984, 9:49383 (R;US)

Anchor Hocking Corp., Lancaster, OH (USA)
Use of furnace curtains to reduce energy consumption in glass annealing furnaces, 9:50055 (R;US)

Animal and Dairy Science Research Inst., Verwoerdburg, Pretoria (South Africa)
Meat symposium. The vital role of science and technology in the meat industry, 9:50613 (R;ZA)

AN SSSR, Leningrad. Inst. Yadernoj Fiziki
Elementary particle physics. Proceedings of 17. Winter school of Leningrad Institute of Nuclear Physics, 9:50760 (R;UA)

AN SSSR, Moscow. Inst. Metallurgii
Thermodynamic properties of gamma-uranium in the formation of solid solutions with alpha-transition metals, 9:50150 (TG;US)

Applied Solar Energy Corp., City of Industry, CA (USA)
Metallization problems with concentrator cells, 9:49616 (R;US)

Argonne National Lab., Idaho Falls, ID (USA)
Hot Fuel Examination Facility's neutron radiography reactor, 9:50366 (R;US)
Status of nuclear data of importance for LMFBR applications prior to the evaluation of ENDF/B-VI, 9:49782 (R;US)

Argonne National Lab., IL (USA)
Accuracy of the finite analytic method for scalar transport calculations, 9:51048 (R;US)
Activity ratios of thorium daughters in vivo, 9:50556 (R;US)
Chelation and effectiveness of salicylate related compounds on pyresis, sedimentation rate and hematocrit, 9:50633 (R;US)
Computer simulation of multiple stability regions in an internally cooled superconducting conductor and of helium replenishment in a bath-cooled conductor, 9:51031 (R;US)
Control of mutagenesis and cell differentiation in cultured human and rodent cells by chemicals that initiate or promote tumor formation, 9:50632 (R;US)
Current (1984) status of the study of ^{226}Ra and ^{228}Ra in humans at the Center for Human Radiobiology, 9:50608 (R;US)
Design features to enhance debris bed coolability, 9:49851 (R;US)
Design of a tensor polarized deuterium target polarized by spin-exchange with optically pumped NA, 9:50459 (R;US)
Enthalpy of formation of americium sesquioxide; systematics of actinide sesquioxide thermochemistry, 9:50297 (R;US)
Evaluating applications of heat recovery incinerators: information and approaches, 9:50062 (R;US)
Evaluation of target purity using various vacuum systems, 9:50460 (R;US)
Evaluation of the core physics and safety characteristics of a quasi-homogeneous LMFBR concept, 9:49849 (R;US)
Existence and structure of rare earth monocarbides: study of their magnetic properties at low temperatures, 9:50171 (TG;US)
Fundamental aspects on ion-beam surface modification: defect production and migration processes, 9:50105 (R;US)
Geometric radiation exchange factors for axial radiative transfer in an LWR core filled with absorbing-emitting gases, 9:49852 (R;US)
Guide to personal desktop computing at ANL, 9:51049 (R;US)
Hybrid system for producing and storing ice, 9:49683 (R;US)
International Nuclear Target Development Society workshop 1983: proceedings, 9:50456 (R;US)
Phonon properties of $LaNbO_4$ deduced from heat-capacity measurements, 9:50185 (R;US)
Picosecond pulse radiolysis studies to understand the primary processes in radiolysis, 9:50346 (R;US)
Premium Coal Sample Program: a model, 9:49376 (R;US)
Radiation damage in an ethylamine-borane:ammonia target, 9:50441 (R;US)
Radiation-induced compositional redistribution and local phase transformation in irradiated alloys, 9:50101 (R;US)
Regional air quality model assessment and evaluation. Final report, 9:50528 (R;US)
RERTR Program: goals, progress and plans, 9:49834 (R;US)

State-of-the-art review of acoustic techniques for application to the nondestructive evaluation of refractory concrete for coal gasification, 9:49329 (R;US)
Status of rf superconductivity at Argonne National Laboratory, 9:50458 (R;US)
Subcable test facility, 9:51030 (R;US)
Thalweg disposal: demonstration of an alternative, 9:50567 (R;US)
Water-level and fuel-failure external monitoring, 9:49850 (R;US)
What restoration ecology can tell us about mycorrhiza, 9:50549 (R;US)

Arizona State Univ., Tempe (USA)
Critical radius and critical number of gas atoms for cavities containing a Van der Waals gas, 9:51018 (R;US)
Incineration of hazardous and low-level radioactive waste by a small generator. Final report, 9:49564 (R;US)

Army Research and Development Command, Dover, NJ (USA)
Survey of the finish characteristics of machined optical surfaces, 9:50365 (R;US)

Army Tank-Automotive Command, Warren, MI (USA)
Military adaptation of commercial items: laboratory evaluation of the Code E-436 engine. Technical report 17 January-28 July 1983, 9:50068 (R;US)
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Associated Nuclear Services, Epsom (UK)
BIOMOD - preliminary findings, 9:49537 (R;GB)
Development of biosphere codes for use in assessment of the radiological impact of geological repositories for radioactive waste, 9:49536 (R;GB)
Development of the biosphere code BIOMOD: final report, 9:49535 (R;GB)
User's guide to the biosphere code BIOMOD, 9:49534 (R;GB)

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Guide and instructions for determining γ-ray emission rates with germanium detector systems, 9:50487 (TG;AU)

Australian Inst. of Nuclear Science and Engineering, Lucas Heights
10th AINSE nuclear physics conference, held from 6th-8th February 1984 at the Australian National University, Canberra, 9:50823 (R;AU)
Third Australian conference on nuclear techniques of analysis, 9:50288 (R;AU)

Automated Industries, Inc., Silver Spring, MD (USA)
Living Systems. Monthly performance report, 9:49695 (R;US)

B

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Molten salt steam generator subsystem research experiment: executive summary. Phase I. Specification and preliminary design. Final report, 9:49673 (R;US)

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Demonstration of furnace curtains to reduce heat energy. Final report, 9:50054 (R;US)

Babcock and Wilcox Co., Barberton, OH (USA)
Molten salt steam generator subsystem research experiment: executive summary. Phase 1, final report, 9:49672 (R;US)

Babcock and Wilcox Co., Barberton, OH (USA). Nuclear Equipment Div.
Molten salt receiver subsystem research experiment: executive summary. Phase I, final report, 9:49674 (R;US)
Molten salt steam generator subsystem research experiment: executive summary. Phase I. Specification and preliminary design. Final report, 9:49673 (R;US)

BASF A.G., Ludwigshafen am Rhein (Germany, F.R.)
Fluorescent dyes for luminescent solar concentrators. Final report, 9:49703 (R;DE;In German)

Battelle Columbus Labs., OH (USA)
Failure mode analysis for lime/limestone FGD system. Volume III. Plant profiles. Part 1 of 3, 9:49401 (R;US)
MARCH 2 (Meltdown Accident Response Characteristics) code description and user's manual, 9:49894 (R;US)
Proceedings: EPRI/TVA biomass workshop on the use of biomass for the generation of electric power, 9:49590 (R;US)

Battelle Human Affairs Research Center, Seattle, WA (USA)
Nuclear waste repository in basalt: preliminary socioeconomic assessment, 9:49558 (R;US)

Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation
Performance assessment plans and methods for the Salt Repository Project, 9:49539 (R;US)

Bayer A.G., Leverkusen (Germany, F.R.)
Development of particle-sizing for high concentrated colloidal dispersions based on photon correlations spectroscopy, 9:50296 (R;DE;In German)

Bechtel National, Inc., Oak Ridge, TN (USA)
Remedial action at the Acid/Pueblo Canyon site, Los Alamos, New Mexico. Final report, 9:49567 (R;US)

Bendix Field Engineering Corp., Grand Junction, CO (USA)
Summary of petrographic and chemical data for Palo Duro Basin samples examined by Bendix Field Engineering Corporation, Grand Junction, Colorado, as of April 29, 1983, 9:49538 (R;US)

Bergbau-Forschung G.m.b.H. Forschungsinstitut des Steinkohlenbergbauvereins, Essen (Germany, F.R.)
Microwave moisture-meter, 9:49419 (R;DE;In German)

Berkeley Research Associates, Inc., CA (USA)
Study of field aligned plasma acceleration during a HANE (High Altitude Nuclear Explosion). Technical report, 9:50511 (R;US)

Bielefeld Univ. (Germany, F.R.). Zentrum fuer Interdisziplinaere Forschung
Current algebra and the local nature of symmetries in local quantum theory, 9:50803 (R;DE)

Bochum Univ. (Germany, F.R.). Abt. fuer Maschinenbau
Microstructure and mechanical properties of titanium alloys, 9:50137 (R;DE;In German)

Bonn Univ. (Germany, F.R.). Physikalisches Inst.
Measurement of coherent $\pi 0$ photoproduction on ^3He and ^3H in the resonance region, 9:50828 (R;DE)

Booz, Allen and Hamilton, Inc., Bethesda, MD (USA)
Adapting state and national electricity consumption forecasting methods to utility service areas. Final report, 9:49956 (R;US)

Bristol Univ. (UK). H.H. Wills Physics Lab.
Ferromagnetism in metals at finite temperatures, 9:50945 (R;US)

British Gas Corp., London
Method for the preparation of a gaseous fuel, 9:49369 (TG;GB)

British Hydromechanics Research Association, Cranfield
Slurry pipeline cost analysis computer program, 9:49418 (R;GB)
Water jet cutting of coal, 9:49409 (R;GB)

Brookhaven National Lab., Upton, NY (USA)
Attempted measurement of gaseous H_2O_2 in the ambient atmosphere, 9:50520 (R;US)
BNL multiparticle spectrometer software, 9:50457 (R;US)
Energy management review, 9:49942 (R;US)
Health and Environmental Risk Analysis Program workshop: potential public health impacts of airborne organic combustion products, 9:50521 (R;US)
Health effects of risk-assessment categories, 9:50629 (R;US)
Hydrothermal durability of Ca-complexed methylmethacrylate-trimethylolpropane trimethacrylate copolymer films and coatings containing superficially formed $CaO-SiO_2-H_2O$ type inorganic macromolecules, 9:50172 (R;US)
MINET simulation of a helical coil sodium/water steam generator, including structural effects, 9:49892 (R;US)
MINET validation study using steam generator transient data, 9:49893 (R;US)

NEANDC specialists meeting on yields and decay data of fission product nuclides, 9:50819 (R;US)
Propagation of sound at continuous structural phase transitions, 9:50941 (R;US)
Proton laser accelerator by means of the inverse free electron laser mechanism, 9:50442 (R;US)
Survey of the finish characteristics of machined optical surfaces, 9:50365 (R;US)
Towards a molecular understanding of sunlight-induced skin cancer in mouse and man, 9:50602 (R;US)
Virus entrainment in a glacial aquifer, 9:50566 (R;US)

Brown Univ., Providence, RI (USA)
Study of heterojunction solar cells based on n-CdS and several P-type semiconductors, 9:49612 (R;US)

Bundesanstalt fuer Geowissenschaften und Rohstoffe, Hannover (Germany, F.R.)
Development of numerical simulation models for vertical solute transport in unsaturated soils and unconsolidated sediments, 9:50554 (R;DE;In German)

Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahlenhygiene
Studies on the 'air-grass-cow-milk' exposure pathway of airborne ^{131}I from Wuergassen nuclear power plant in the 1980 grazing season, 9:50560 (R;DE;In German)

Bundesministerium des Innern, Bonn (Germany, F.R.)
Benefit effort relation of sacrificial layers, 9:49845 (R;DE;In German)
Criticality experiments of the years 1981 and 1982, 9:49796 (R;DE;In German)
HTCC - a heat transfer model for gas-steam mixtures, 9:49846 (R;DE;In German)

Bundesministerium des Innern, Bonn (Germany, F.R.). Abt. Reaktorsicherheit und Strahlenschutz
Investigation of the meltdown accident with special regard to the radiological state of knowledge, 9:49847 (R;DE;In German)

Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)
Development of particle-sizing for high concentrated colloidal dispersions based on photon correlations spectroscopy, 9:50296 (R;DE;In German)
Drying grapes with solar energy, 9:49682 (R;DE;In German)
Fluorescent dyes for luminescent solar concentrators. Final report, 9:49703 (R;DE;In German)
Increase of efficiency in cooled high temperature turbines. Phase I, 9:50069 (R;DE;In German)
Microbial degradation of high nitrogen contents (primarily nitrate) in industrial waste water, 9:50598 (R;DE;In German)
Microwave moisture-meter, 9:49419 (R;DE;In German)
Novel shield support for coal faces worked by shearer loaders in difficult geological conditions with modern ergonomic layout, 9:49410 (R;DE;In German)
Technical equipment for rescuing injured miners in case of roof breaks in coal faces and roadways, 9:49439 (R;DE;In German)

Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)
CSSR - energy situation 1980/81, 9:49950 (R;DE;In German)

Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center
Calamity Hollow Mine Fire Project. 3. Instrumentation for combustion monitoring, process control, and data recording. Report of investigations/1984, 9:49415 (R;US)
Electric arcing at high voltage during methane-air explosions inside explosion-proof enclosures. Technical progress report, 9:50364 (R;US)
Geologic factors in coal mine roof stability--a progress report. Information circular/1984, 9:49416 (R;US)

Burns and Roe/Humphreys-Glasgow Synthetic Fuels, Inc., Oradell, NJ (USA)
SRC-1: coal liquefaction demonstration plant. Project Baseline assessment report supplement, 9:49347 (R;US)

Burt, Hill, Kosar, Rittlemann, and Associates, Butler, PA (USA). Research and Solar Applications Div.
Automated installation methods for photovoltaic Arrays II, 9:49624 (R;US)

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C

Cable Technology Labs., Inc., New Brunswick, NJ (USA)
Determination of threshold and maximum operating electric stresses for selected high voltage insulations. Task III. Investigation of high voltage capacitor insulation. Progress report No. 4, 9:49759 (R;US)

Caen Univ., 14 (France). Lab. de Physiologie Vegetale
Absorption of ^{45}Ca during the immersion of the aerial organs of Salicornia stricta, 9:50603 (R;FR;FR)

California Inst. of Tech., Pasadena (USA)
Elemental advances of ultraheavy cosmic rays, 9:50700 (R;US)
Properties and thermal stabilities of amorphous transition metal hydrides, 9:50163 (R;US)

California Inst. of Tech., Pasadena (USA). Dept. of Chemical Engineering
Effect of pressure on the mechanical properties of polymers. Part II. Measurement of the time-dependent Poisson's ratio. Final report, 9:50177 (R;US)

California Univ., Berkeley (USA)
High resolution hard X-ray spectra of solar and cosmic sources, 9:50684 (R;US)
Proceedings of the third biennial synfuels wastewater workshop, 9:49387 (R;US)
Some self-dual SO(3) solutions of the Yang-Mills equation and a note on harmonic maps, 9:50816 (D;US)

California Univ., Berkeley (USA). Coll. of Engineering
Designing for fatigue with random vibration excitation, 9:50415 (R;US)

California Univ., Berkeley (USA). Dept. of Materials Science and Mineral Engineering
Sub-eutectic densification and second phase formation in Al_2O_3 - CaO, 9:50162 (R;US)

California Univ., Los Angeles (USA)
Characteristics of the magnetospheric source of interplanetary energetic particles, 9:50716 (R;US)
Magnetic field of Mars: implications from gasdynamics modeling, 9:50686 (R;US)
Petroleum effects on neural systems in marine organisms. Progress report, 1 August 1979-14 April 1980, 9:50634 (R;US)

California Univ., Los Angeles (USA). Dept. of Medicine
Delayed immunologic effects of low dose radiation in Japanese A-bomb survivors. Technical progress report, 9:50609 (R;US)

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Novel analytical approaches to the study of coal beneficiation. Quarterly report, 9:49382 (R;US)

California Univ., San Diego, La Jolla (USA). Inst. of Pure and Applied Physical Sciences
Study of avalanche discharge lasers. Final technical report 1 July 1975-30 September 1983, 9:50391 (R;US)

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Studies relevant to the catalytic activation of carbon monoxide: the water gas shift reaction and related processes. Technical progress report, December 1, 1983-November 30, 1984, 9:49330 (R;US)

California Univ., Santa Barbara (USA). Dept. of Mechanical and Environmental Engineering
Convection heat transfer in the critical region of fluid mixtures. Progress report, 9:50399 (R;US)

California Univ., Santa Barbara (USA). Inst. for Theoretical Physics
Reduction of the wavepacket: how long does it take, 9:50967 (R;US)

California Univ., Santa Barbara (USA). Marine Science Inst.
Petroleum effects on neural systems in marine organisms. Progress report, 1 August 1979-14 April 1980, 9:50634 (R;US)

Calspan Advanced Technology Center, Buffalo, NY (USA)
CO_2 gamma 3 fundamental band 4.5 micrometers laser potential. Final report 2 May 1983-26 March 1984, 9:50393 (R;US)

Canada Mortgage and Housing Corp., Ottawa, Ontario
Energy efficiency in multi-unit residential buildings: a handbook for owners and operators, 9:49998 (R;CA)

Carnegie-Mellon Univ., Pittsburgh, PA (USA). Dept. of Civil Engineering
Recent field studies of dry deposition to surfaces in piant canopies, 9:50522 (R;US)

Carrier Corp., Syracuse, NY (USA). Energy Systems Div.
Fabrication, testing, installation, and start-up of a 53 kW solar absorption cooling system, 9:49685 (R;US)
Case Western Reserve Univ., Cleveland, OH (USA)
Large unbalance vibration analysis of steam turbine generators. Final report, 9:49746 (R;US)
New polymer electrodes and conductors based on poly(hydroquinone/quinone) oxidation/reduction systems. Technical progress report, 9:50176 (R;US)
Catalytic, Inc., Philadelphia, PA (USA)
Design baseline: 6000 tpd SRC-1 Demonstration Plant. Volume 4 (revised), 9:49350 (R;US)
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Monte Carlo calculation with unquenched Wilson-Fermions, 9:50801 (R;DE)
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Directions in low-level radioactive-waste management. Incentives and compensation: providing resources for communities hosting low-level waste facilities, 9:49543 (R;US)
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Modeling of real UT transducer field/flaw interactions, 9:50410 (R;US)
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F

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Information on coal conversion activities at selected powerplants, 9:49953 (R;US)
Information on relicensing cases at the Federal Energy Regulatory Commission, 9:49597 (R;US)
Information on repayment of the government's uranium enrichment program costs and audits of that program's financial statements, 9:49524 (R;US)
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Influence of adsorber performance on plant design for the extraction of uranium from seawater, 9:49508 (R;DE)
Measurement and calculation of the three-dimensional instationary temperature field in underwater welded plates, 9:50112 (R;DE;In German)
Neutron induced irradiation damage in amorphous Fe40Ni40B20, 9:50188 (R;DE;In German)
Sequential Analyse of the data of a monitor for radioactive radiation, 9:50477 (R;DE;In German)
Some economic considerations for a pilot plant based on the adsorber loop concept, 9:49525 (R;DE)
Test field Pellworm for wind turbines, 9:49736 (R;DE;In German)
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New results in quantum supergravity, 9:50966 (R;HU)
One-loop infinities in dimensionally reduced supergravities, 9:50965 (R;HU)
Pinning of charge density waves by irradiation induced defects in orthorhombic TaS_3, 9:50201 (R;HU)
Proposal for electron beam induced remote sensing x-ray fluorescence investigation of minor bodies in the solar system. Experiment IND-X, 9:50673 (R;HU)
Quantum relativity theory, 9:50963 (R;HU)
Simulation of the dynamic behaviour of the primary circuit in a WWER-440 type nuclear power plant Pt. 1, 9:49777 (R;HU)
Transition scattering and transition bremsstrahlung in a dense plasma - a step towards soft x-ray lasers, 9:51008 (R;HU)
Volume corrections for the specific entropy in nucleon-deuteron mixtures, 9:50914 (R;HU)

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Ingenieurhochschule Zwickau (German Democratic Republic)
Fuel savings by advanced vehicle drive systems, 9:50076 (R;DD;In German)

Institute of Nuclear Energy Research, Lung-Tan (Taiwan)
Solving of inverse Z-transfer function by recurrent permutation method, 9:50978 (R;TW)

Institute of Nuclear Energy Research, Lung-Tan (Taiwan). Technical Information Center
Coefficients determination of differential state equations from Laplace transfer function, 9:51052 (R;TW;CH)
Laboratory scale studies of $SiHCl_3$ synthesis, 9:50300 (R;TW;CH)
SKYSHINE-P: a point kernel computer program for calculating SKYSHINE exposure rates, 9:50929 (R;TW;CH)

Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)
Timing analysis of hard X-ray emission and 22 GHz flux and polarization in a solar burst, 9:50688 (R;BR)

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Manual on quality assurance programme auditing, 9:49789 (R;AT)
Oceanographic model for the dispersion of wastes disposed of in the deep sea, 9:50577 (R;XA)
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International Coal Refining Co., Allentown, PA (USA)
Assessment of feedability of Kerr-McGee ash concentrate, 9:49345 (R;US)
SRC-1: coal liquefaction demonstration plant. Project Baseline assessment report supplement, 9:49347 (R;US)

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Catalytic coal gasification, 9:49359 (R;GB)

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Quark hadron phase transition in bianchi type I cosmologies, 9:50672 (R;IT)

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J

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Neutron nuclear data of ^{9}Be adopted in JENDL-2, 9:50846 (R;JP)
Neutron nuclear data of ^{7}Li adopted in JENDL-2, 9:50845 (R;JP)
Preliminary results of the partial array LCT coil tests, 9:51029 (R;US)

JAYCOR, Alexandria, VA (USA)
Concept for operations in a nuclear environment. Technical report, 9:50509 (R;US)

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Assessment of how residential passive solar systems impact utilities. Final report, 9:49686 (R;US)

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Assessment of feedability of Kerr-McGee ash concentrate, 9:49345 (R;US)

Jet Propulsion Lab., Pasadena, CA (USA)
Advanced cogeneration research study. Executive summary, 9:49939 (R;US)
Assessment of advanced technology for industrial cogeneration, 9:49938 (R;US)
Chemical bonding technology for terrestrial photovoltaic modules, 9:49619 (R;US)
Cogeneration computer model assessment: advanced cogeneration research study, 9:49940 (R;US)
Dual arm master controller concept, 9:49515 (R;US)
Effects of expiration of the federal energy tax credit on the National Photovoltaics Program, 9:49602 (R;US)
Experimental and theoretical study of a solar thermochemical receiver module, 9:49666 (R;US)
Getting the current out, 9:49615 (R;US)
JPL tests of a LaJet concentrator facet, 9:49705 (R;US)
NASA flight electronics environmental stress screening survey, 9:50423 (R;US)
Nomographic methodology for use in performance trade-off studies of parabolic dish solar power modules, 9:49664 (R;US)
Nonaerospace uses of JPL technology: a report on technology transfer, 9:51045 (R;US)
Photovoltaic power conditioning subsystem: state of the art and development opportunities, 9:49654 (R;US)
Progress report 22, January-September 1983 and proceedings of the 22nd Project Integration meeting, 9:49607 (R;US)
Solar tests of aperture plate materials for solar thermal dish collectors, 9:49706 (R;US)
Survey of cogeneration: advanced cogeneration research study, 9:49941 (R;US)
Survey of gas-side fouling in industrial heat-transfer equipment. Final report, 9:50052 (R;US)
Survey of manufacturers of high-performance heat engines adaptable to solar applications, 9:49665 (R;US)
Wind loading on solar concentrators: some general considerations, 9:49663 (R;US)

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Characteristics of the magnetospheric source of interplanetary energetic particles, 9:50716 (R;US)

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Operation of the EPRI Nondestructive Evaluation Center. 1983 annual report, 9:49933 (R;US)

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Alcohol fuel from Ohio farms, 9:49584 (R;US)

K

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Theoretical and experimental studies on the limits of capacity of the thermal reactor in after-treatment of exhaust gases, 9:50087 (R;DE;In German)

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Characterization of oil shale mine waters, central Piceance Basin, Colorado. Final report, 9:49505 (R;US)

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Vadose zone monitoring for hazardous waste sites, 9:50553 (R;US)

Kando (Paul F.), Inc., Washington, DC (USA)
Industrial work on latent heat storage, 9:49718 (R;US)

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Effects of prescribed fire on water quality at the Santee Experimental Watersheds in South Carolina, 9:50545 (R;US)

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Study of the gas phase deposition of silicon carbide and its application for impregnation of reactively bound silicon carbide and for the manufacture of SiC/SiC composites, 9:50164 (R;DE;In German)

Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Elektrotechnik
Dose estimation by simultaneous measurement of the radon/thoron concentration and the equilibrium factors in air using a passive dosemeter, 9:50480 (R;DE;In German)
Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Maschinenbau
Accuracy of X-ray lithography using synchrotron radiation for the fabrication of technical separation nozzle elements, 9:49511 (R;DE;In German)
Experiment for triggered fragmentation with a molten copper-drop in water, 9:50401 (R;DE;In German)
Fluid-structure-interaction of the pressurized water reactor core internals during blowdown - numerical simulation with a homogenization model, 9:49883 (R;DE;In German)
Relations between material properties and performance of wear resistant materials, 9:50161 (R;DE;In German)
Karlsruhe Univ. (TH) (Germany, F.R.). Rechenzentrum
Development of self-adaptive difference method for the solution of three-dimensional laminar incompressible boundary layer equations with arctrolled error, 9:50403 (R;DE;In German)
Kearney (A.T.), Inc., Alexandria, VA (USA)
Review and evaluation of costs and benefits from various oil shale strategies. Final report, 9:49504 (R;US)
Keplinger and Associates, Inc., Tulsa, OK (USA)
Project evaluation: Penn Grade Micellar Displacement Project, 9:49446 (R;US)
Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Chemische Technologie der Nuklearen Entsorgung
Aqueous chemical reprocessing of HTR fuel, 9:49518 (R;DE)
Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Medizin
Retention of incorporated radionuclides after variable application of gamma-rays, 9:50614 (R;DE;In German)
Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Sicherheitsforschung
Special analyses of the temperature and fission product behaviour of HTR-MODUL plants, 9:49861 (R;DE;In German)
Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorbauelemente
Effective thermal conductivity in packed beds of spheres especially in the core of a high temperature reactor, 9:49780 (R;DE;In German)
Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung
Installation of a three-dimensional simulation method for core-physical description of pebble bed reactors with multiple recycling process at the example of the AVR, 9:49800 (R;DE;In German)
Safety conception of the high temperature reactor with natural heat removal decay in the case of accidents, 9:49860 (R;DE;In German)
Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorwerkstoffe und Heisse Zellen
Investigations of the double plasma arc in a graphite tube, 9:50289 (R;DE;In German)
Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Programmgruppe Systemforschung und Technologische Entwicklung
Electricity production cost in coal and nuclear power plants, 9:49794 (R;DE;In German)
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Internal safeguards for centrifuge enrichment plants. Concepts and procedures for safeguards and the international Hexapartite Safeguards Project (HSP), 9:49569 (R;DE;In German)
Joint US-German evaluation of electronic safeguards seal systems, 9:49570 (R;DE)
Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Zentralabteilung Brennelement- und Bestrahlungstechnologie
Fundamentals for the evaluation of irradiation experiments on enrichment reduction in the FRJ-2 (AF-Programme), 9:49837 (R;DE;In German)
Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Zentralinstitut fuer Angewandte Mathematik
Analytical model for an input/output-subsystem, 9:51055 (R;DE;In German)
Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)
Preliminary results of the partial array LCT coil tests, 9:51029 (R;US)
Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Sicherheit
Annual report 1983 of Hauptabteilung Sicherheit, 9:49874 (R;DE;In German)
Dose estimation by simultaneous measurement of the radon/thoron concentration and the equilibrium factors in air using a passive dosemeter, 9:50480 (R;DE;In German)
Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Heisse Chemie
Dissolution of unirradiated UO_2-pellets in nitric acid, 9:49521 (R;DE;In German)
Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik
Dynamic density dependence of the alpha-nucleon force in folding models of inelastic scattering of alpha-particles, 9:50865 (R;DE)
Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kernverfahrenstechnik
Accuracy of X-ray lithography using synchrotron radiation for the fabrication of technical separation nozzle elements, 9:49511 (R;DE;In German)
Investigations into the operating behavior of separation nozzle cascades for uranium-235 enrichment in a 10-stage pilot plant, 9:49510 (R;DE;In German)
Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Material- und Festkoerperforschung
Relations between material properties and performance of wear resistant materials, 9:50161 (R;DE;In German)
Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik
KANDY - a numerical model to describe phenomena, which - in a heated and voided fuel element of an LMFBR - may occur, 9:49882 (R;DE;In German)
Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Radiochemie
Decontamination of carbonate containing process streams in a reprocessing plant by chromatography, 9:49519 (R;DE;In German)
Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorbauelemente
Heat transfer in rod bundles with severe clad deformations, 9:49871 (R;DE)
Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung
Experiment for triggered fragmentation with a molten copper-drop in water, 9:50401 (R;DE;In German)
Fluid-structure-interaction of the pressurized water reactor core internals during blowdown - numerical simulation with a homogenization model, 9:49883 (R;DE;In German)
Scientific work of Leonardo Caldarola, 9:49884 (R;DE;In German)
SSYST-3. Input description, 9:49873 (R;DE;In German)
Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Technische Physik
Advanced superconducting materials, 9:50129 (R;DE)
INTOR phase IIA, magnet system design - European contribution, 9:51034 (R;DE)
Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Lab. fuer Aerosolphysik und Filtertechnik 1
DEMONA - research program for the demonstration of nuclear aerosol behaviour, 9:49872 (R;DE;In German)
Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Kernfusion
INTOR phase IIA, magnet system design - European contribution, 9:51034 (R;DE)
TASKA-M - a low cost, near term tandem mirror device for fusion technology testing, 9:51033 (R;DE)
Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Nukleare Sicherheit
DEMONA - research program for the demonstration of nuclear aerosol behaviour, 9:49872 (R;DE;In German)
Fluid-structure-interaction of the pressurized water reactor core internals during blowdown - numerical simulation with a homogenization model, 9:49883 (R;DE;In German)
Proceedings of the 1982 annual colloquium of the Project Nuclear Safety, 9:49862 (R;DE;In German)

Proceedings of the 1983 annual colloquium of the Project Nuclear Safety, 9:49875 (R;DE;In German)
SSYST-3. Input description, 9:49873 (R;DE;In German)
Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Schneller Brueter
Experiment for triggered fragmentation with a molten copper-drop in water, 9:50401 (R;DE;In German)
KANDY - a numerical model to describe phenomena, which - in a heated and voided fuel element of an LMFBR - may occur, 9:49882 (R;DE;In German)
Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Wiederaufarbeitung und Abfallbehandlung
Decontamination of carbonate containing process streams in a reprocessing plant by chromatography, 9:49519 (R;DE;In German)
Dissolution of unirradiated UO_2-pellets in nitric acid, 9:49521 (R;DE;In German)
Kiel Univ. (Germany, F.R.)
Measurement of heavy cosmic-ray nuclei on LDEF (M0002-2), 9:50678 (R;DE)
Kiruna Geofysiska Inst. (Sweden)
Observations of He+ ions in the solar wind, 9:50683 (R;SE)
Kraftwerk Union A.G., Erlangen (Germany, F.R.)
Investigation of the meltdown accident with special regard to the radiological state of knowledge, 9:49847 (R;DE;In German)
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L

Lawrence Berkeley Lab., CA (USA)
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Calculated masses and half-lives for nuclei in the region 100 ≦ Z ≦ 110, 9:50905 (R;US)
Calculation and computer simulation of the Paraboloidal Mirror Analyzer (PMA), 9:50746 (R;US)
Calorimetric investigation into the possibility of a charge density wave ground state in alkali metals, 9:50133 (R;US)
Cerenkov detector for heavy-ion velocity measurements, 9:50482 (R;US)
Chaos and related nonlinear noise phenomena in Josephson tunnel junctions, 9:50955 (R;US)
Comparisons of predicted and measured energy use in occupied buildings, 9:49994 (R;US)
dc SQUID as a tuned radiofrequency amplifier, 9:50373 (R;US)
Downhole sampling of geopressured gas wells. Final report, June 1982-July 1984, 9:49477 (R;US)
Effect of resonant microwave power on a PIG ion source, 9:50743 (R;US)
Energy conservation in public housing: the San Francisco experience, 9:49996 (R;US)
Evidence for a solar companion star, 9:50675 (R;US)
Introduction to LBL graphics, 9:51057 (R;US)
Kinetics of oxygen exchange between bisulfite ion and water as studied by oxygen-17 nuclear magnetic resonance spectroscopy, 9:50302 (R;US)
Lighting controls: the role of advanced technology - past, present, and future, 9:49995 (R;US)
New lighting technologies, their status and impacts on power densities, 9:49997 (R;US)
Polyelectrolytes as interfaces for retarding back-reaction in photoinduced electron transfer, 9:50335 (R;US)
Portable, public domain LEX for the Software Tools, 9:51056 (R;US)
Resonant activation of a Josephson junction, 9:50372 (R;US)
Steady flow model user's guide, 9:49908 (R;US)
Structure determination of molecular adsorbates with dynamical LEED and HREELS, 9:50745 (R;US)
Structure of adsorbed monolayers. The surface chemical bond, 9:50744 (R;US)
Sub-eutectic densification and second phase formation in Al_2O_3 - CaO, 9:50162 (R;US)
Subnanosecond time-resolved emission study of Cu_2O and GaAs, 9:50203 (R;US)
Thermodynamic properties of aqueous NaCl from 273 to 823 K with estimates for higher temperatures, 9:50301 (R;US)
Three-dimensional vortex methods, 9:50756 (R;US)
Time-resolved resonant Raman scattering and hot luminescence at the 1S ortho-exciton in Cu_2O, 9:50747 (R;US)
Transmission electron microscopy of inorganic materials, 9:50092 (R;US)
Lawrence Livermore National Lab., CA (USA)
Absolute dipole gamma-ray strength functions for ^{176}Lu, 9:50894 (R;US)
Calculated masses and half-lives for nuclei in the region 100 ≦ Z ≦ 110, 9:50905 (R;US)
Categorization of PWR accident sequences and guidelines for fault trees: seismic initiators, 9:49901 (R;US)
Centralia double module in situ coal gasification test conceptual design, 9:49362 (R;US)
Dynamic stellar neutron-capture nucleosynthesis: the need for more nuclear data for the s-process, 9:50703 (R;US)
Evolution of the mirror approach to fusion: some conjectures, 9:51038 (R;US)
Experimental high pressure equation of state of a very fast burning gun propellant, 9:50506 (R;US)
Feasibility of using fiber optics for monitoring ground water contaminants, 9:50580 (R;US)
Feasibility study: vertical fracturing in directionally drilled wells. Final report, January 1983-September 1983, 9:49482 (R;US)
Integration of an automated library support system with an intelligent gateway, 9:51063 (R;US)
Isomer ratio calculations using modeled discrete levels, 9:50893 (R;US)
Kitchensink titrations, 9:50303 (R;US)
Measurement of proton autoneutralization potential, 9:51010 (R;US)
Method for treatment of wastewater of nuclear power plants, 9:49832 (TG;US)
MFTF-α+T: an upgrade to the MFTF-B, 9:51020 (R;US)
New downhole cable emplacement method developed for LLNL's Nuclear Test Program, 9:50512 (R;US)
Optimization of the die entrance shape for polymeric extrusion, 9:50178 (R;US)
Performance of the Cascade inertial-confinement-fusion conceptual reactor, 9:51037 (R;US)
Plasma-surface interactions in large tandem mirror devices - MFTF-B, 9:51009 (R;US)
Power of deterministic thinking in machine tool accuracy, 9:50382 (R;US)
Probability of pipe failure in the reactor coolant loops of Combustion Engineering PWR plants. Volume 2. Pipe failure induced by crack growth, 9:49890 (R;US)
Proposed reference set of scenarios for radiatively active atmospheric constituents, 9:50526 (R;US)
Report of the Long-Range Planning Committee, 9:51047 (R;US)
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Tritium/deuterium gas cell, 9:50465 (R;US)
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Effects of electromagnetic fields produced by high voltage transmission lines. Final report, 9:50652 (R;US)
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Actinides: from heavy fermions to plutonium metallurgy, 9:50132 (R;US)
Alumina/silica multilayer coatings for excimer lasers, 9:50395 (R;US)
Analysis of n + ^{197}Au cross sections for E/sub n/ = 0.01-20 MeV, 9:50902 (R;US)
Application of layered synthetic microstructures to high-temperature plasma diagnostics, 9:50498 (R;US)
Applied nuclear data research and development. Semiannual progress report, April 1-September 30, 1983, 9:50824 (R;US)
Attenuation of chemical elements in acidic leachates from coal mineral wastes by soils, 9:49407 (R;US)
Calculated masses and half-lives for nuclei in the region 100 ≦ Z ≦ 110, 9:50905 (R;US)
Contributions of pair correlations to pion-nucleus double charge exchange, 9:50916 (R;US)
CW operation of the FMIT RFQ accelerator, 9:50448 (R;US)
Development of a high current H^- injector for the proton storage ring at LAMPF, 9:50463 (R;US)
Fabrication of SiC whiskers and composites, 9:50174 (R;US)
High-precision isotopic analysis of nanogram quantities of plutonium, 9:50290 (R;US)
LAMPF II, 9:50447 (R;US)
Medium energy probes and the IBM, 9:50915 (R;US)

Metallographic grinding efficiency, 9:50414 (R;US)
Monte Carlo error analysis in x-ray spectral deconvolution, 9:50481 (R;US)
Multiparameter light scattering for rapid virus identification, 9:50599 (R;US)
New look at small power plants: an update on the environmental issues of interest to Italy, 9:49757 (R;US)
New phases and chemical reactions in solid CO under pressure, 9:50202 (R;US)
Nuclear Plant Analyzer: an interactive TRAC/RELAP Power-Plant Simulation Program, 9:49886 (R;US)
Portable radiography using linear accelerators, 9:49572 (R;US)
Proceedings of the seventeenth LAMPF Users Group meeting, 9:50446 (R;US)
Reduction of the wavepacket: how long does it take, 9:50967 (R;US)
Safety analysis and review system (SARS), 9:49932 (R;US)
Simulation of bent crystal spectrometers, 9:50499 (R;US)
Thermodynamic properties of gamma-uranium in the formation of solid solutions with alpha-transition metals, 9:50150 (TG;US)
What are squeezed states really like, 9:50968 (R;US)
X-ray emission from Centaurus A, 9:50674 (R;US)

Los Angeles County Sanitation Districts, Whittier, CA (USA)
Thermal treatment of municipal sewage sludges, 9:50551 (R;US)

Lund Inst. of Tech. (Sweden). Dept. of Mathematical Physics
Steady flow model user's guide, 9:49908 (R;US)

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Martin Marietta Labs., Baltimore, MD (USA)
Mechanisms of cake filtration. Progress report, 9:50262 (R;US)
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Mechanisms of cake filtration. Third progress report, Part II, September 1981-April 1984, 9:50265 (R;US)

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Evaluation of end-cap-less tensile specimen for explosive testing, 9:50505 (R;US)

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Preliminary results of the partial array LCT coil tests, 9:51029 (R;US)

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Energy demand in the transportation sector of Mexico, 9:49944 (R;US)
Experiment to evaluate methods for estimating fossil fuel resources, 9:49444 (R;US)

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Enhanced sputtering of graphite at high temperature, 9:50718 (R;US)
Plasma surface interaction processes and possible synergisms, 9:51026 (R;US)

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Bose-fermi U(6/2j+1) supersymmetries and high spin anomalies, 9:50903 (R;AU)
Comment on '(p,n) and (n,p) reactions as probes of isovector giant monopole resonances', 9:50917 (R;AU)
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Explosive safety criteria at a Department of Energy contractor facility, 9:50419 (R;US)
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Physical and chemical problems with reclamation of conifers, 9:49412 (R;US)

Motoren- und Turbinen-Union G.m.b.H., Muenchen (Germany, F.R.)
Increase of efficiency in cooled high temperature turbines. Phase I, 9:50069 (R;DE;In German)

N

Natal Univ., Durban (South Africa)
Laboratory measurements of subsynchronous resonance, 9:49762 (R;ZA)

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Development of a simplified procedure for cyclic structural analysis, 9:50078 (R;US)
Frictional and morphological properties of Au-MoS2 films sputtered from a compact target, 9:50204 (R;US)
Voltage controlling mechanisms in low resistivity silicon solar cells: a unified approach, 9:49613 (R;US)
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A radiometric Bode's Law: Predictions for Uranus, 9:50701 (R;US)
Acceleration of runaway electrons and Joule heating in solar flares, 9:50682 (R;US)
Coalescence of two pressure waves associated with stream interactions, 9:50689 (R;US)
Cosmic rays and the emission line regions of active galactic nuclei, 9:50694 (R;US)
Energetic electrons in impulsive solar flares, 9:50696 (R;US)
Nuclear processes in the jets of SS433, 9:50693 (R;US)
TOPEX orbital radiation study, 9:50695 (R;US)
National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center
A comparative look at sunspot cycles, 9:50697 (R;US)
Linear energy transfer spectrum measurement experiment (P0006), 9:50679 (R;US)
Trapped-proton energy spectrum determination (M0002-1), 9:50715 (R;US)
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Assessment of research needs for advanced battery systems, 9:49913 (R;US)
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Problems of small, high-technology firms, 9:49926 (R;US)
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Flux diffusion and acceleration in a high current modified betatron. Memorandum report, 9:50451 (R;US)
Heavy ions in space (M0001), 9:50677 (R;US)
Influence of microturbulence on early time HANE structure. Memorandum report, 9:50818 (R;US)
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NERVA Test Operations, Jackass Flats, NV (USA)
NERVA Program. Operating procedure: cart cooling system, Test Cell A, 9:49844 (R;US)
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Economic evaluation of a district heating plant in Trysil, 9:49925 (R;NO;In Norwegian)
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Morphological instabilities and ion beam mixing in Ge. Revision, 9:50099 (R;US)
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Alaska Natural Gas Transportation System, 9:49485 (R;US)
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Safety evaluation report related to the operation of Shoreham Nuclear Power Station, Unit No. 1 (Docket No. 50-322). Supplement No. 7, 9:49887 (R;US)
Safety Evaluation Report related to the renewal of the operating license for the Westinghouse research reactor at Zion, Illinois (Docket No. 50-87), 9:49888 (R;US)
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O

Oak Ridge Associated Universities, Inc., TN (USA)
Arc-evaporated carbon films: optical properties and electron mean free paths, 9:50163 (R;US)
Calculated masses and half-lives for nuclei in the region $100 \leqq Z \leqq 110$, 9:50905 (R;US)
Experimental verification of eddy-current flaw theory, 9:50408 (R;US)
Reliability of the quantification of EELS measurements, 9:50158 (R;US)
Oak Ridge National Lab., TN (USA)
Accelerator-colliders for relativistic heavy ions or in search of luminosity, 9:50444 (R;US)
Advanced latent heat storage media for high-temperature industrial applications, 9:49907 (R;US)
Advanced performance fusion engineering device based on low safety factor and current drive (FED-A), 9:51022 (R;US)
Advanced Research and Technology Development Fossil Energy Materials Program. Quarterly progress report ending June 30, 1984, 9:50094 (R;US)
Allocation and apportionment of joint-use cost to power: a report on the assessment of headwater benefits charges, 9:49599 (R;US)
Alloying effects and microstructure of iron aluminides, 9:50097 (R;US)
Amorphous materials and recrystallization, 9:50420 (R;US)
Anomalous mean free paths for scattering of convoy electrons generated by fast, highly ionized ions in thin solid targets, 9:50725 (R;US)
Application of extraction replicas and analytical electron microscopy to precipitate phase studies, 9:50100 (R;US)
Approaches to radiation guidelines for space travel, 9:50607 (R;US)
Arc-evaporated carbon films: optical properties and electron mean free paths, 9:50183 (R;US)
Assessment of research and development for the management of fossil energy-related solid wastes, 9:49399 (R;US)
Automatic camera tracking for remote manipulators, 9:49516 (R;US)
Beginner's guide to blocked records on magnetic tape, 9:51058 (R;US)
Bird communities and vegetation structure in pine plantations of the southeastern Coastal Plain, 9:50546 (R;US)
Boron-induced toughness loss in Ti-6A1-2Nb-1Ta-0.8Mo, 9:50107 (R;US)
Brief description of the Wackersdorf reprocessing installation, 9:49522 (TG;US)
Bulk Shielding Facility. Quarterly report, January-March 1984, 9:49838 (R;US)
Chaos near the Coulomb barrier. Nuclear molecules, 9:50833 (R;US)
Chemistry and fate of disinfection by-products, 9:50568 (R;US)
Comments on the image contrast from inelastically scattered electrons, 9:50724 (R;US)
Comparison of electron cyclotron heating theory and experiment in EBT, 9:51001 (R;US)
Comparison of tree growth models, 9:50548 (R;US)
Composite latent/sensible energy storage media for high-temperature industrial applications, 9:49905 (R;US)
Conformations of DNA adducts with polycyclic aromatic carcinogens, 9:50587 (R;US)
Critical radius and critical number of gas atoms for cavities containing a Van der Waals gas, 9:51018 (R;US)
Design and biological properties of iodine-123 labeled β-methyl-branched fatty acids, 9:50589 (R;US)
Design and fabrication of a beryllium limiter for ISX-B, 9:51027 (R;US)
Design of ordered intermetallic alloys for high-temperature structural use, 9:50096 (R;US)
Direct comparison of unloading compliance and potential drop techniques in J-integral testing, 9:50409 (R;US)
D-T axicell magnet system for MFTF-α+T, 9:51021 (R;US)
Dual arm master controller concept, 9:49515 (R;US)
Effects of dc electric fields on multiphoton ionization spectra in cesium, 9:50726 (R;US)
Effects of prescribed fire on water quality at the Santee Experimental Watersheds in South Carolina, 9:50545 (R;US)
Electron spectrometry experiments with the use of synchrotron radiation, 9:50722 (R;US)
Electron-hole plasma formation in semiconductors due to the absorption of pulsed CO_2 laser light, 9:50944 (R;US)
Emerging role of the national laboratory in the development and transfer of materials technology, 9:50089 (R;US)
Enhanced sputtering of graphite at high temperature, 9:50718 (R;US)
Evaluation of two conceptual wastewater treatment schemes for a Lurgi-based indirect coal liquefaction plant, 9:49360 (R;US)
Experience highlights from the design and manufacture of US LCT coils, 9:51028 (R;US)
Experimental determination of the critical cavity radius in Fe-10% Cr for ion irradiation, 9:50098 (R;US)
Experimental studies of random-field effects in uniaxial random antiferromagnets, 9:50942 (R;US)
Experimental verification of eddy-current flaw theory, 9:50408 (R;US)
Exposure and risk calculations for disposal of wastes having minimal radioactivity, 9:49566 (R;US)
Fabrication of ceramic-ceramic composites by chemical vapor deposition, 9:50173 (R;US)
Far-infrared laser diagnostic on EBT and extreme far-forward laser scattering on ISX, 9:51002 (R;US)
Ferromagnetism in metals at finite temperatures, 9:50945 (R;US)
Filling the gap through teleoperation, 9:50495 (R;US)
Forest growth trends in the eastern United States: status report on empirical and modeling approaches, 9:50524 (R;US)

Forest nutrient cycles as affected by climate, species composition, stand age, and intensive harvesting, 9:49605 (R;US)
Formation of amorphous layers in Al_2O_3 by ion implantation, 9:50157 (R;US)
Forward electron production in heavy ion-atom and ion-solid collisions, 9:50723 (R;US)
Fossil Energy Technology Environmental Program information system: making the data accessible, 9:49405 (R;US)
10-GeV heavy-ion collider, 9:50443 (R;US)
Grouting of uranium mill tailings piles, 9:49541 (R;US)
Hadron-lepton cascade calculations (1-20 GeV) for a Pb-Al-lucite calorimeter, 9:50484 (R;US)
Health and environmental monitoring at the University of Minnesota-Duluth coal gasification facility. Draft, 9:49404 (R;US)
High temperature aqueous solutions and energy considerations - physical chemical studies, 9:50298 (R;US)
House thermal envelope conservation optimization with respect to performance/economics, 9:49968 (R;US)
Impact analysis speculations regarding the Pacific Northwest Power Planning Council prescriptive building standards applied to the public utilities service area new housing starts, 9:49980 (R;US)
Impact of maximum TF magnetic field on performance and cost of an advanced physics tokamak, 9:51025 (R;US)
Impacts of bioturbation on the age difference between benthic and planktonic foraminifera in deep sea sediments, 9:50655 (R;US)
Inhalation pathway risk assessment of hazardous waste incineration facilities, 9:50636 (R;US)
Instrumentation and Controls evaluation for space nuclear power systems, 9:49817 (R;US)
Instrumentation for occupational health research, 9:50494 (R;US)
Ion beam processes in Si, 9:50184 (R;US)
Ion implantation of surgical Ti-6Al-4V alloy, 9:50590 (R;US)
Issues in the design of a computer-aided systems and control analysis and design environment (CASCADE), 9:50374 (R;US)
LSL-M1 and LSL-M2: two extensions of the LSL adjustment procedure for including multiple spectrum locations, 9:49797 (R;US)
Magnetism of californium metal, 9:50102 (R;US)
Matrix scientist in a matrix organization, 9:50261 (R;US)
Metals and Ceramics Division progress report for period ending June 30, 1984, 9:50093 (R;US)
MFTF-α+T: an upgrade to the MFTF-B, 9:51020 (R;US)
Microstructure of rapidly quenched type 308 stainless steel weld filler metal and its implications on rapid solidification processes, 9:50104 (R;US)
Model of the world oil market with an OPEC cartel, 9:49461 (R;US)
Morphological instabilities and ion beam mixing in Ge. Revision, 9:50099 (R;US)
Multiphoton ionization of atomic cesium, 9:50721 (R;US)
Multiphoton ionization of benzene in solution, 9:50334 (R;US)
Multiphoton ionization of cesium atoms above and below the two-photon ionization threshold, 9:50719 (R;US)
Muscle atrophy and restoration during molting, 9:50600 (R;US)
National need for utilizing nuclear energy for process heat generation, 9:49795 (R;US)
Near-threshold production of neutral π mesons in heavy-ion reactions, 9:50848 (R;US)
Neutron deficient mass surface between the 1f/sub 7/2/ and 1g/sub 9/2/ shells: the masses of ^{77}Kr and ^{78}Kr, 9:50867 (R;US)
Nuclear molecules in TDHF, 9:50834 (R;US)
Optically induced intervalence-band transitions in germanium by the absorption of 1.06 μm picosecond pulses, 9:50943 (R;US)
ORNL evaluation of the ORR-PSF metallurgical experiment and blind test, 9:49833 (R;US)
Perspective on demonstrations of compliance for high-level waste disposal, 9:49540 (R;US)
Photoacoustic spectroscopy at electrode-solution interface, 9:50329 (R;US)
Plasma surface interaction processes and possible synergisms, 9:51026 (R;US)
Preliminary results of the partial array LCT coil tests, 9:51029 (R;US)
Radiation, chemicals, and occupational health research, 9:50605 (R;US)
Radiation research report, 9:50604 (R;US)
Reactivity of ion implanted silicon carbide, 9:50160 (R;US)
Recent advances in data compression, 9:51050 (R;US)
Recent field studies of dry deposition to surfaces in plant canopies, 9:50522 (R;US)
Reliability of the quantification of EELS measurements, 9:50158 (R;US)
Report on NCI symposium: comparison of mechanisms of carcinogenesis by radiation and chemical agents. II. Cellular and animal models, 9:50606 (R;US)
Resistivity of alloys, 9:50946 (R;US)
Review of areas that may require simultaneous coupled solution of the thermal hydraulic and fission product/aerosol behavior equations for source term determination, 9:49853 (R;US)
Role of boron additions on grain-boundary chemistry and tensile properties of Ni_3Al containing 24 and 26 at. % Al, 9:50106 (R;US)
Role of calcium-dependent proteinase in molt-induced claw muscle atrophy, 9:50601 (R;US)
SANS and TEM studies of carbide precipitation and creep damage in type 304 stainless steel, 9:50103 (R;US)
Separation of lithium ions by chromatography, 9:50259 (R;US)
Simulating responses to expected climate change in eastern North America: applications to decision-making in the forest industry, 9:50547 (R;US)
Size distribution of planktonic autotrophy and microheterotrophy in DeGray Reservoir, Arkansas, 9:50564 (R;US)
SKINATH - a computer program for solving the reactor point kinetics equations with simple thermal-hydraulic feedback, 9:49801 (R;US)
Solid wastes from coal and shale: projections of waste forms and utilization potential, 9:49384 (R;US)
Solvent fermentations of pulp streams and their constituents, 9:50316 (R;US)
Some aspects of understanding changes in the global carbon cycle, 9:50523 (R;US)
Specification and cost manual for energy retrofits on small commercial and multifamily buildings, 9:49690 (R;US)
Striped bass, temperature, and eutrophication: a speculative hypothesis for environmental risk, 9:50563 (R;US)
Studies of charged-particle tracks in liquid water, 9:50926 (R;US)
Surface mechanical properties and wear behavior of ion implanted TiB_2, 9:50159 (R;US)
Swelling and swelling resistance possibilities of austenitic stainless steels in fusion reactors, 9:50095 (R;US)
Transportation energy use and efficiency in Tunisia, 9:50028 (R;US)
Transportation energy use and efficiency in Tunisia, 9:50032 (R;US)
Transuranium Processing Plant report of production, status, and plans for October 1, 1980-March 31, 1983, 9:50350 (R;US)
Tritium pellet injection sequences for TFTR, 9:51024 (R;US)
Twenty-seventh ORNL/DOE conference on analytical chemistry in energy technology: abstracts, 9:50258 (R;US)
Use of cytogenetic endpoints in human lymphocytes as indicators of exposure to genotoxicants, 9:50630 (R;US)
Using PAFEC as a preprocessor for MSC/NASTRAN, 9:51023 (R;US)
Vacuum ultraviolet photoionization of cold molecular beams, 9:50720 (R;US)
X-ray microprobe characterization of materials: the case for undulators on advanced storage rings, 9:50260 (R;US)

Oak Ridge Y-12 Plant, TN (USA)
Grouting of uranium mill tailings piles, 9:49541 (R;US)
Ultrasonic analysis of spherical composite test specimens, 9:50416 (R;US)
Ultrasonic girth weld evaluation for aluminum substrate of spherical Kevlar-epoxy test specimens, 9:50418 (R;US)
Use of the analytic signal in ultrasonic imaging, 9:50417 (R;US)

Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.
Austrian contributions to fuel rod failure models shown at the International Standard Problem ISP-14, 9:49896 (R;AT;In German)
Austrian primary standard for ionizing radiation dosimetry. Results of international intercomparisons, 9:50940 (R;AT)
Considerations on the dimensioning of decay tanks for liquid radioactive wastes. Basic methods and examples, 9:49553 (R;AT;In German)
Department of Chemistry of the Austrian Research Centre Seibersdorf, 9:50257 (R;AT;In German)
Design and operational experience with the off-gas cleaning system of the Seibersdorf incinerator plant, 9:49552 (R;AT)
Immobilization of toxic waste by embedding into bitumen, 9:50057 (R;AT;In German)
Method for non contacting gauging of the wall thickness of tubes by backscattering of radiation, 9:50483 (R;AT;In German)

Observation of single phonon scattering of Ne^{20}-atoms from a LiF (001) surface, 9:50749 (R;AT)
On-stream determination of Zn-content in Zn-ore slurries by radioisotope excited X-ray fluorescence, 9:50291 (R;AT)
Operating experience with potassium systems, 9:49750 (R;AT)
Physical models and numerical methods of the reactor dynamic computer program RETRAN, 9:49895 (R;AT;In German)
Radiation protection problems by nonionizing electromagnetic radiation in Austria, 9:50653 (R;AT)
Radiation-curable impregnating agents for the conservation of archaelogic wooden objects, 9:50347 (R;AT;In German)
Radiation-curable impregnating agents for the conservation of archaeologic wooden objects. Part 2, 9:50348 (R;AT;In German)
Uranium content in surface air in Vienna during the years 1963/64 and 1974 - 1978, 9:50541 (R;AT;In German)
Wear measurements of cutting tools made of hard metal, 9:49573 (R;AT;In German)

Ohio Agricultural Research and Development Center, Wooster (USA)
Conserving energy in Ohio glass greenhouses. Final report, March 1, 1978-December 31, 1980, 9:50000 (R;US)

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Low-cost approach to local government energy contingency planning, 9:49947 (R;US)
Remote sensing survey of energy losses from public buildings. Final report, 9:50002 (R;US)

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Annual report 1981, 9:49443 (R;NO)

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Energy conservation building operations demonstration for forty high-, medium- and low-rise multiple-unit residential buildings, 9:50011 (R;CA)
High efficiency condensing furnace field study, final report (project report No. 3B), 9:50014 (R;CA)
High efficiency residential condensing gas forced air and high efficiency pulse boilers field evaluation - final report (project report No. 5B), 9:50012 (R;CA)
Improved efficiency domestic hot water tank field study - installation report - report No. 8A, 9:50010 (R;CA)
Medium efficiency non-condensing furnace field study - installation report - report No. 9A, 9:50013 (R;CA)
Report on the energy management installation at 1765 Weston Road, 9:50009 (R;CA)
Season interim performance report on the field operation of a residential space heating system, 1982/1983 (project report No. 6B), 9:49490 (R;CA)

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Technical papers presented at the thirteenth Dragon Countries physics meeting, 9:49779 (R;GB)

Otter Group, Trondheim (Norway)
Ekofisk E-data. Data report: Jan-Jun 1982, 9:50515 (R;NO)
Statfjord E-data. Data report: Jan-Dec 1981, 9:50517 (R;NO)
Statfjord E-data. Data report: Jan-Dec 1982, 9:50516 (R;NO)

P

Pacific Northwest Lab., Richland, WA (USA)
Amorphous phase formation in irradiated intermetallic compounds, 9:50138 (R;US)
Assessment of technical strengths and information flow of energy conservation research in Japan. Volume 1. Executive summary, 9:49943 (R;US)
Catalysts for gasification of biomass, 9:49586 (R;US)
Characterization of emergency preparedness at DOE contractor facilities, 9:49897 (R;US)
Comparing computing formulas for estimating concentration ratios, 9:50561 (R;US)
Consideration of future climatic changes in three geologic settings, 9:49554 (R;US)
Development of an advanced water-gas shift conversion system. Monthly project status report No. 6, September 1-30, 1984, 9:49357 (R;US)
Dry storage of LWR spent fuel in the US: a status report, 9:49523 (R;US)
Emerging technology of synthetic aperture focusing for ultrasonic testing, 9:49814 (R;US)
Evaluation of a draft standard on performance specifications for health physics instrumentation: results for environmental tests, 9:50486 (R;US)
Field testing of aquifer thermal energy storage, 9:49910 (R;US)
Gasification of biomass for the production of methanol and ammonia, 9:49587 (R;US)
GT2R2: an updated version of GAPCON-THERMAL-2, 9:49816 (R;US)
Impact of Lupinus leucophyllous on the nitrogen budgets of semi-arid plant communities, 9:50550 (R;US)
MESOI, an interactive atmospheric dispersion model for emergency response applications, 9:50542 (R;US)
Models for mixture experiments when the response depends on the total amount, 9:50359 (R;US)
Monitoring technology trends with patent data: fouling of heat exchangers. A case study, 9:50061 (R;US)
Mutagenicity and carcinogenicity of polycyclic aromatic enriched fractions from coal liquefaction materials, 9:50637 (R;US)
Nuclear waste glass composition limitations, 9:49557 (R;US)
Off-gas treatment and characterization for a radioactive in situ vitrification test, 9:49556 (R;US)
Organizational tools for data analysis environments, 9:51060 (R;US)
Outcome of compressed air energy storage at Pittsfield, Illinois, 9:49904 (R;US)
Pipe to pipe impact, 9:49898 (R;US)
Pump for metering high-level waste and glass former mixtures to an electric melter, 9:49555 (R;US)
Role of environments in managing data analysis, 9:51059 (R;US)
Safeguards and security design guidelines for conceptual monitored retrievable storage (MRS) facilities, 9:49571 (R;US)
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Validation of geochemical models, 9:50667 (R;US)
Weather data for simplified energy calculation methods. Volume I. Eastern United States: TRY data, 9:50019 (R;US)
Weather data for simplified energy calculation methods. Volume II. Middle United States: TRY data, 9:50020 (R;US)
Weather data for simplified energy calculation methods. Volume III. Western United States: TRY data, 9:50021 (R;US)
Weather data for simplified energy calculation methods. Volume IV. United States: WYEC data, 9:50022 (R;US)

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Benchmark calculations for MTR type cores, 9:49841 (R;PK)
Calculations of K with burn-up for various enrichments for MTR type core, 9:49842 (R;PK)
Mathematical formulation of temperature fluctuation and control rod vibration in PARR, 9:49839 (R;PK)

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Exploration for tritium-free water, 9:50352 (R;PK)
Preparation of radioactive tracer for studying sediment movement, 9:50668 (R;PK)
Program for TI programmable 59 calculator for calculation of ^3H concentration of water samples, 9:50351 (R;PK)
Purification of tritium-free water, 9:50353 (R;PK)

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Puerto Rico Univ., Mayaguez
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R

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Oil supply disruptions and the role of the International Energy Agency, 9:49459 (R;US)
Risk aversion and the insurance value of strategic oil stockpiling, 9:49458 (R;US)
Strategic oil stocks and public-private interactions: a dynamic game analysis, 9:49457 (R;US)
Transport costs and the spatial distribution of natural gas prices, 9:49479 (R;US)
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Test of windmill control unit from Skjern Elektro Aps and Styrdata, 9:49740 (R;DK;In Danish)
Test report for Kramsbjerg windmill 14 kW. Standard measurements, 9:49739 (R;DK;In Danish)
Test report for VESTAS windmill, type 15, 55 kW. Standard measurements, 9:49738 (R;DK;In Danish)
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Analysis of changes introduced under the proposed OCS leasing schedule, 9:49456 (R;US)
Analysis of proposed changes to federal surface mining and coal leasing policy, 9:49442 (R;US)
Identification of changes introduced under the proposed OCS leasing schedule, 9:49467 (R;US)
Summary of United States-Canada and United States-Mexico maritime boundary disputes in relationship to hydrocarbon resources, 9:49469 (R;US)
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Outer Continental Shelf oil and gas activities in the Gulf of Alaska and their onshore impacts. Gulf of Alaska summary report update, May 1984, 9:49449 (R;US)
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Experimental investigation of post dryout heat transfer, 9:49885 (R;SE)
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Ruhrkohle A.G., Essen (Germany, F.R.)
Novel shield support for coal faces worked by shearer loaders in difficult geological conditions with modern ergonomic layout, 9:49410 (R;DE;In German)
Technical equipment for rescuing injured miners in case of roof breaks in coal faces and roadways, 9:49439 (R;DE;In German)
Rutherford Appleton Lab., Chilton (UK)
Charm photoproduction at 20 GeV, 9:50770 (R;GB)

S

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Coolability of UO_2 debris beds in pressurized water pools: DCC-1 and DCC-2 experiment results. Revision, 9:49899 (R;US)
Design and fabrication of a beryllium limiter for ISX-B, 9:51027 (R;US)
Growth and properties of semiconductor strained-layer superlattices, 9:50186 (R;US)
NBS frequency measurement system from a user's viewpoint, 9:50502 (R;US)
Photonic methods of high speed analog data recording, 9:50501 (R;US)
Photovoltaic concentrator technology project, 9:49625 (R;US)
Process evaluation of the human reliability data bank, 9:49937 (R;US)
Properties and thermal stabilities of amorphous transition metal hydrides, 9:50163 (R;US)
Review of regulatory requirements governing control room habitability systems, 9:49827 (R;US)
Three-dimensional model for a porous elastic anisotropic solid with inclusions, taking into account dissipation, heat flux, radiation and thermal stress, 9:51061 (R;US)
Two-dimensional modeling of conduction-mode laser welding, 9:50139 (R;US)
Underground system for disposal of contact handled transuranic waste at the potential Yucca Mountain repository, 9:49559 (R;US)
Sandia National Labs., Livermore, CA (USA)
Enhanced sputtering of graphite at high temperature, 9:50718 (R;US)
Medium speed computer interface (digitizer) for general purpose data acquisition, 9:50503 (R;US)
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Sentralinstitutt for Industriell Forskning, Oslo (Norway)
High reliability instrumentation systems, 9:50436 (R;NO;In Norwegian)
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Environmental analysis of Bonneville Power Administration - prescribed audit-based electric energy conservation measures in ten selected industries, 9:50582 (R;US)
Shapiro and Associates, Inc., Seattle, WA (USA)
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Air quality monitoring at Sullom Voe using lichens as biological indicator species: results of the 1981 and 1982 repeat photographic surveys, 9:49466 (R;GB)
Report to SOTEAG (Shetland Oil Terminal Environmental Advisory Group) on numbers of Tysties ('Cepphus grylle') in the area of the Yell Sound Islands, September 1982, 9:49463 (R;GB)
Report to the Shetland Oil Terminal Environmental Advisory Group on the 1982 and 1983 surveys of Eider moult flocks, 9:49462 (R;GB)
Report to the Shetland Oil Terminal Environmental Advisory Group on the Shetland Beached Bird Survey, March 1982-February 1983, 9:49464 (R;GB)
Report to the Shetland Oil Terminal Environmental Advisory Group on the Beached Bird Survey in Shetland, March 1980-February 1982, with a review of results since July 1978, 9:49465 (R;GB)
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Directional wave spectra from the Frigg Field in the North Sea, 9:50581 (R;NO)
Gas injection in heterogeneous reservoirs. Analytical solution No. 1, 9:49450 (R;NO)
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Measurements of 55 kW Nordtank windmill sited at Knebel, Mols. Background report, 9:49741 (R;DK;In Danish)
Measurements of 55 kW Nordtank windmill sited at Knebel, Mols, 9:49742 (R;DK;In Danish)
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Autos 82. Volume 1. Automation in engineering, 9:50370 (R;CS;CZ)
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Southern California Edison Co., Rosemead (USA)
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Metallic-rectifier battery chargers for lead-acid batteries. Specification No. A10-1976 (Revision of A10-1972), 9:49912 (R;US)
10-MWe solar thermal central receiver pilot plant operational test management plan. Three year power production phase effective August 1, 1984, 9:49671 (R;US)
Solar One, 9:49678 (R;US)
Solar One Generating Station, Daggett, California: Start-up and Test Program Manual, 9:49669 (R;US)
Specification for Information Center, Solar One Generating Station. Addendum No. 1, 9:49668 (R;US)
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Southern States Energy Board, Atlanta, GA (USA)
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Commission enforcement. National Low-Level Radioactive Waste Management Program, 9:49547 (R;US)
Commission operation. National Low-Level Radioactive Waste Management Program, 9:49546 (R;US)
SRI International, Menlo Park, CA (USA)
Regional air quality model assessment and evaluation. Final report, 9:50528 (R;US)
Stanford Linear Accelerator Center, CA (USA)
Multimode harmonic power measurement of 40 MW pulsed S-band klystrons, 9:50464 (R;US)
Phase displacement acceleration in the SSC, 9:50454 (R;US)
Surface studies of Nb, its compounds, and coatings, 9:50140 (R;US)
Using television cameras to measure emittance, 9:50453 (R;US)
Stanford Univ., CA (USA)
Emission model of gamma-ray bursts, 9:50698 (R;US)
Experimental investigation of the characteristics of an ultraviolet storage ring laser, 9:50475 (R;US)
Extragalactic radio sources, 9:50690 (R;US)
Hard X-ray and microwave morphology, 9:50692 (R;US)
Stanford Univ., CA (USA). Dept. of Physics
Application of layered synthetic microstructures to high-temperature plasma diagnostics, 9:50498 (R;US)
Stanford Univ., CA (USA). Edward L. Ginzton Lab.
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Collecting well in fine sediment as heat storage for a block of flats in Karlstad. A preliminary study, 9:49967 (R;SE;In Swedish)
Lake water heat for a heating central at Kvarnberget, Falun, Sweden. Preliminary study, 9:50064 (R;SE;In Swedish)
Waste heat recovery from waste water with a heat pump for 400 flats in Falun. Project plan, 9:50063 (R;SE;In Swedish)
Statens Vattenfallsverk, Vaellingby (Sweden). Projekt KOL-HAELSA-MILJOE
Cost of coal-fired plants and related equipment for environmental protection, 9:49748 (R;SE;In Swedish)
Effects of solid fuel fired plants for district heating. Air quality studies in two towns, 9:49406 (R;SE;In Swedish)
Mercury species present in smoke from coal fire. Water soluble mercury species in air and precipitation, 9:50530 (R;SE;In Swedish)
Studies on the leaching and weathering processes of coal ashes, 9:49398 (R;SE;In Swedish)
Use of basin ash as fill material on dry level, 9:49396 (R;SE;In Danish)
Use of conditioned fly ash as fill material, 9:49397 (R;SE;In Danish)
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Attempted measurement of gaseous H_2O_2 in the ambient atmosphere, 9:50520 (R;US)
Stieff Research and Development Co., Inc., Kensington, MD (USA)
Feasibility of the use of nuclear-emulsion techniques in the study of drill core and water samples from the Monticello mill, Monticello, Utah, 9:49568 (R;US)
Stone and Webster Engineering Corp., Boston, MA (USA)
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Strategies Unlimited, Mountain View, CA (USA)
Wind power parks: 1983 survey, 9:49735 (R;US)
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Heat transfer in a closed thermosyphon tube filled with near critical fluid, 9:50404 (R;DE;In German)
Stuttgart Univ. (Germany, F.R.). Inst. fuer Kernenergetik und Energiesysteme
Method for convergence acceleration of iterative solutions of eigenvalue-problems in reactor theory and implementation in the DIFGEN-code, 9:49798 (R;DE;In German)
Sveriges Lantbruksuniversitet, Garpenberg. Institutionen foer Skogsteknik
Optiflow. Description of a system for regional analysis of flow and utilization of forest raw materials, and one method of application, 9:49920 (R;SE;In Swedish)
Sydney Univ. (Australia). Dept. of Plasma Physics
Wills Plasma Physics Department annual progress report, 9:51007 (R;AU)
Synergic Resources Corp., Bala-Cynwyd, PA (USA)
Environmental analysis of Bonneville Power Administration - prescribed audit-based electric energy conservation measures in ten selected industries, 9:50582 (R;US)

T

Technische Hochschule Aachen (Germany, F.R.)
Analytical model for an input/output-subsystem, 9:51055 (R;DE;In German)
Installation of a three-dimensional simulation method for core-physical description of pebble bed reactors with multiple recycling process at the example of the AVR, 9:49800 (R;DE;In German)
Investigations of the double plasma arc in a graphite tube, 9:50289 (R;DE;In German)
Retention of incorporated radionuclides after variable application of gamma-rays, 9:50614 (R;DE;In German)
Safety conception of the high temperature reactor with natural heat removal decay in the case of accidents, 9:49860 (R;DE;In German)
Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Elektrotechnik
Contribution to the description of the electrical behaviour of lead, nickel-cadmium, and nickel-iron accumulators, 9:49914 (R;DE;In German)
Process-included topological changes of monocrystalline silicon plates, 9:50205 (R;DE;In German)
Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Maschinenwesen
Influence of particles in diesel engine exhaust gas during cooling and mixing with the surrounding air, 9:50080 (R;DE;In German)
Water electrolysis using hybrid cyclic processes, 9:49574 (R;DE;In German)
Technische Hochschule Aachen (Germany, F.R.). Inst. for Metallurgical Science
Alternating-pressure underground gasification, 9:49367 (TG;US)
Technische Hochschule Aachen (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet
Use of novel catalysts founded on basic-fixed hydride-carbonyl complexed for the Fischer-Tropsch synthesis, 9:49579 (R;DE;In German)
Technische Hochschule Darmstadt (Germany, F.R.). Fachbereich Maschinenbau
Dissertation on a direct injection Diesel process with automatic control, dependent on load, of the ratio of the fuel adhering to the walls to that distributed in the air, with particular attention to exhaust gas turbo-supercharging and exhaust gas feedback, 9:50082 (R;DE;In German)
Reduction of emission of particles, carcinogenic polycyclic hydrocarbons and nitric oxides of a direct injection diesel engine by the diesel-gas process, 9:50081 (R;DE;In German)
Static and dynamic strength of gas turbine blade material under conditions of high temperature corrosion, 9:50136 (R;DE;In German)
Technische Hochschule Darmstadt (Germany, F.R.). Inst. fuer Mikrobiologie
Microbial degradation of high nitrogen contents (primarily nitrate) in industrial waste water, 9:50598 (R;DE;In German)
Technische Univ. Braunschweig (Germany, F.R.). Fakultaet fuer Maschinenbau und Elektrotechnik
Modelling of the overall aeroelastic system of a windturbine aided by symbolic programming, 9:49733 (R;DE;In German)
Technische Univ. Clausthal, Clausthal-Zellerfeld (Germany, F.R.). Fakultaet fuer Bergbau, Huettenwesen und Maschinenwesen
Development of a melting apparatus for lithium-containig magnesium-aluminium alloys and its application in thermal analysis, 9:50135 (R;DE;In German)
Evaporation of R11/R113 mixtures at a horizontal cylinder in crossflow, 9:50402 (R;DE;In German)
Model investigations about flow in industrial halls with heat sources, 9:50405 (R;DE;In German)
Phase equilibria in aluminium-lithium-magnesium alloys at 200°C, 300°C and 400°C and their hardening in a casting state, 9:50134 (R;DE;In German)
Technische Univ. Muenchen, Garching (Germany, F.R.). Fakultaet fuer Physik
Propagation of sound at continuous structural phase transitions, 9:50941 (R;US)
Technische Univ. Muenchen (Germany, F.R.). Fakultaet fuer Elektrotechnik
Analysis of the technical and energetical operation behavior of cogeneration plants, 9:50053 (R;DE;In German)
Energy characteristics of road vehicles represented by the example of an electric transporter, 9:50085 (R;DE;In German)
Technische Univ. Muenchen (Germany, F.R.). Inst. fuer Mathematik
Repeated measurements in quantum theory, 9:50969 (R;DE)
Tekniska Hoegskolan, Lund (Sweden)
Ignition probing by laser techniques. Preliminary experiments, 9:50077 (R;SE)

Tennessee Dept. of Conservation, Nashville (USA). Div. of Geology
Geologic map and mineral resources summary of the Sewanee Quadrangle, Tennessee, 9:49408 (R;US)
Tennessee Univ., Knoxville (USA)
Automatic camera tracking for remote manipulators, 9:49516 (R;US)
Experimental verification of eddy-current flaw theory, 9:50408 (R;US)
Far-infrared laser diagnostic on EBT and extreme far-forward laser scattering on ISX, 9:51002 (R;US)
Forward electron production in heavy ion-atom and ion-solid collisions, 9:50723 (R;US)
Tennessee Univ., Knoxville (USA). Dept. of Nuclear Engineering
SKINATH - a computer program for solving the reactor point kinetics equations with simple thermal-hydraulic feedback, 9:49801 (R;US)
Tennessee Univ., Knoxville (USA). Dept. of Physics
Anomalous mean free paths for scattering of convoy electrons generated by fast, highly ionized ions in thin solid targets, 9:50725 (R;US)
Magnetism of californium metal, 9:50102 (R;US)
Multiphoton ionization of benzene in solution, 9:50334 (R;US)
Tennessee Univ., Knoxville (USA). Dept. of Physics and Astronomy
Vacuum ultraviolet electronic properties of liquids. Annual progress report, February 1, 1984-January 31, 1985, 9:50927 (R;US)
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Microprocessor-based monitoring and control project. Phase I report, 9:50504 (R;US)
Tennessee Valley Authority, Chattanooga (USA). Office of Power
Cost classification approaches in TVA cost-of-service methodology, 9:49958 (R;US)
Tennessee Valley Authority, Knoxville (USA). Office of Natural Resources and Economic Development
Floods on Duck River in the vicinity of Centerville, Tennessee, 9:50661 (R;US)
Texas A and M Univ., College Station (USA). Cyclotron Inst.
Neutron deficient mass surface between the 1f/sub 7/2/ and 1g/sub 9/2/ shells: the masses of ^{77}Kr and ^{78}Kr, 9:50867 (R;US)
Texas A and M Univ., College Station (USA). Dept. of Physics
Topics in high resolution spectroscopy of stored ions, 9:50728 (R;US)
Texas A and M Univ., College Station (USA). Research Foundation
Transient creep of repository rocks. Mechanistic creep laws for rock salt. Final report, 9:50665 (R;US)
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Study of scale and noncondensables in an evaporator. Annual report, 1 October 1983-30 September 1984, 9:49729 (R;US)
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Shear-Alfven dynamics of toroidally confined plasmas. Part A, 9:51005 (R;US)
Shear-Alfven dynamics of toroidally confined plasmas. Part B, 9:51006 (R;US)
Toledo Univ., OH (USA)
Thermal stress analysis for a wood composite blade, 9:49737 (R;US)
TRANSCOMM, Inc., Falls Church, VA (USA)
Nuclear Regulatory Commission's antitrust review process: an analysis of the impacts, 9:49934 (R;US)
TRC Environmental Consultants, Inc., Englewood, CO (USA)
Regional air quality model assessment and evaluation. Final report, 9:50528 (R;US)
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Programme of research into the management and storage of radioactive waste. Aqueous phase transport through granitic rocks. Annual report 1983, 9:49531 (R;GB)
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Radionuclide source term and migration. Progress report April 1983 - September 1983, 9:49526 (R;GB)
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Laboratory techniques for safe encapsulation of α-emitting powder samples, 9:50363 (R;GB)
UKAEA Atomic Energy Research Establishment, Harwell. Environmental and Medical Sciences Div.
Contamination surveys of plant room and roof-void in B. 154 at the National Physical Laboratory, Teddington, 9:50362 (R;GB)
Final report on contamination surveys at NPL, 9:50361 (R;GB)
UKAEA Atomic Energy Research Establishment, Harwell. Materials Development Div.
Corrosion studies on containment materials for vitrified high level nuclear waste. Annual progress report for 1983, 9:49532 (R;GB)
UKAEA Atomic Energy Research Establishment, Harwell. Nuclear Physics Div.
Uranium series disequilibrium measurements at MOL and Whiteshell. Annual progress report for 1983, 9:49530 (R;GB)
UKAEA Atomic Energy Research Establishment, Harwell. Theoretical Physics Div.
Programme of research into the management and storage of radioactive waste. Mathematical modelling. Annual report 1983, 9:49529 (R;GB)
UKAEA Culham Lab., Abingdon
Non-inductive current drive in tokamaks, 9:51000 (R;GB)
UKAEA Safety and Reliability Directorate, Culcheth
Causes of larger degraded core frequencies in earlier safety studies compared with Sizewell 'B', 9:49900 (R;GB)
Umweltbuadesamt, Berlin (Germany, F.R.)
Development of numerical simulation models for vertical solute transport in unsaturated soils and unconsolidated sediments, 9:50554 (R;DE;In German)
Underwriters Labs., Inc., Northbrook, IL (USA)
Proposed first edition of the standard for flat-plate photovoltaic modules and panels, UL 1703, 9:49621 (R;US)
Safety requirements for wiring systems and connectors for photovoltaic systems. Final report, 9:49608 (R;US)
Union Carbide Corp., Oak Ridge, TN (USA). Nuclear Div.
Assembly and installation of a pair of superconducting buses for the Large Coil Test Facility, 9:51019 (R;US)
Perspective on demonstrations of compliance for high-level waste disposal, 9:49540 (R;US)
United Engineers and Constructors, Philadelphia, PA (USA). Advanced Engineering Dept.
Technical reference book for the Energy Economic Data Base (EEDB) Program, 9:49791 (R;US)
United Technologies Corp., East Hartford, CT (USA)
Study of pipeline applications of fuel cells. Final report, 9:49961 (R;US)
United Technologies Corp., South Windsor, CT (USA). Power Systems Div.
Phosphoric acid electric utility fuel cell technology development. Technical progress report No. 13, 9:49962 (R;US)
United Technologies Research Center, East Hartford, CT (USA)
Assessment of nonlatent heat storage technologies for industrial applications, 9:49906 (R;US)
Universidad Nacional Autonoma de Mexico, Mexico City. Facultad de Quimica
Exposition index calculation from different points in a gamma sterilization plant radiation room, 9:50935 (R;MX;In Spanish)
Universities Research Reactor, Risley (UK)
Annual report 1982-83, 9:49836 (R;GB)
University City Science Center, Philadelphia, PA (USA)
Effectiveness assessment visits. Energy Analysis and Diagnostic Centers, October-November 1981, 9:49974 (R;US)
Energy management assistance for small and medium-size manufacturers. A third-stage evaluation of the 1981-1983 EADC program, 9:49972 (R;US)

Energy management assistance for small and medium-size manufacturers. A first-stage evaluation of the 1981-1983 program, 9:49975 (R;US)
Energy management assistance for small and medium-size manufacturers. An evaluation of the EADC program, 9:49979 (R;US)
Energy management assistance for small and medium-size manufacturers. A first-stage evaluation of the 1983-1984 EADC program, 9:49970 (R;US)
Implementation of EADCs' recommendations to conserve energy and save dollars (1981-1982), 9:49978 (R;US)
Implementation of energy conservation opportunities by small and medium-size manufacturers. Second phase, 1981-1983 EADC program, 9:49976 (R;US)
Implementation results and financial returns from EADCs' recommendations to conserve energy and control costs. Second phase, 1981-1983 program, 9:49973 (R;US)
Implementation results and financial returns from EADCS' recommendations to conserve energy and control costs. Third phase, 1981-1983 program, 9:49971 (R;US)
Manufacturing costs, equipment needs and technological opportunities among small and medium-size manufacturers, 9:50034 (R;US)
Program of direct energy conservation assistance for medium-size and small manufacturers. Energy Analysis and Diagnostic Centers, September 1981-September 1982, 9:49977 (R;US)
Program of direct energy efficiency improvement for medium-size and small manufacturers. Energy Analysis and Diagnostic Centers phase three of the 1981 to 1983 program , 9:50035 (R;US)

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Remote assessment of permeability/thermal diffusivity of consolidated clay sediments, 9:49551 (R;GB)

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Improved polymers for enhanced oil recovery synthesis and rheology. Sixth annual report, October 1982-September 1983, 9:49447 (R;US)

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USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC
Appendices A, B, and C of the methodology for life cycle cost analysis using average fuel costs, 9:49955 (R;US)

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Statement of Deputy Assistant Secretary for the Strategic Petroleum Reserve before the Subcommittee on Oversight and Investigations of the Committee on Energy and Commerce, US House of Representatives, 9:49473 (R;US)

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Safety analysis and review system (SARS), 9:49932 (R;US)

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Environmental assessment on Bonneville Power Administration's proposed policy for sales of nonfirm energy for service to loads with alternate fuel capability, 9:50583 (R;US)

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Petroleum supply monthly, July 1984, 9:49454 (R;US)

USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels
Annual outlook for US coal, 1984: with projections to 1995, 9:49436 (R;US)
Coal distribution, January-June 1984, 9:49435 (R;US)

USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas
Natural gas monthly, July 1984, 9:49478 (R;US)
Petroleum marketing monthly, July 1984, 9:49455 (R;US)

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Semi-annual report of the Department of Energy, Operational Safety, Health and Environment Division - Quality Assessment Program, 9:50539 (R;US)
Strontium-90 in the US diet, 1982, 9:50557 (R;US)

USDOE Federal Energy Regulatory Commission, Washington, DC. Office of Hydropower Licensing
Water resources appraisal for hydroelectric licensing: Middle San Joaquin Valley basin, Fresno, Madera, Mariposa, and Merced Counties, California, 9:49593 (R;US)
Water resources appraisal for hydroelectric licensing: Middle San Joaquin Valley basin, Fresno, Madera, Mariposa, and Merced Counties, California, 9:49594 (R;US)

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Contaminant control in hot coal derived gas streams: proceedings, 9:49388 (R;US)

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Annual report and summaries of FY 1984 activities supported by the Division of Biological Energy Research, 9:49606 (R;US)

USDOE Office of Energy Research, Washington, DC. Chemical Sciences Div.
Summaries of FY 1984 research in the chemical sciences, 9:50256 (R;US)

USDOE Office of Energy Research, Washington, DC. Engineering, Mathematics and Geosciences Div.
Summaries of physical research in the geosciences, 9:50654 (R;US)

USDOE Office of Energy Research, Washington, DC. Materials Sciences Div.
Materials Sciences programs, Fiscal Year 1984, 9:50090 (R;US)

USDOE Office of Energy Research, Washington, DC. Office of Basic Energy Sciences
Carbon dioxide and climate: summaries of research in FY 1983 and FY 1984, 9:50525 (R;US)

USDOE Office of Inspector General, Washington, DC
Department-wide review of advance financing by letter of credit, 9:51046 (R;US)
Revenues derived from work performed for non-federal entities, 9:49923 (R;US)

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L-Reactor operation, Savannah River Plant, Aiken, SC. Draft environmental impact statement. Volume 1, 9:50584 (R;US)
L-Reactor operation, Savannah River Plant, Aiken, SC. Draft environmental impact statement. Volume 2. Appendices, 9:50585 (R;US)

USDOE Technical Information Center, Oak Ridge, TN
Atmospheric science and power production, 9:50527 (R;US)
High-level radioactive wastes. Supplement 1, 9:49548 (R;US)

USDOE, Washington, DC
Health and environmental monitoring at the University of Minnesota-Duluth coal gasification facility. Draft, 9:49404 (R;US)

V

Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)
Methods for measuring the airtightness and air change rates in buildings, 9:50023 (R;FI;In Finnish)

Vanderbilt Univ., Nashville, TN (USA). Dept. of Computer Science
Extension of the multiconfiguration Hartree-Fock program for continuum functions, 9:50729 (R;US)

Varian Associates, Inc., Palo Alto, CA (USA)
60 GHz Gyrotron Development Program. Quarterly report No. 18, October-December 1983, 9:51035 (R;US)

Vesco Instruments, Plainview, NY (USA)
Dry etching of metallization, 9:50422 (R;US)

Veterans Administration Medical Center, Los Angeles, CA (USA). Geriatric Research, Education and Clinical Center
Delayed immunologic effects of low dose radiation in Japanese A-bomb survivors. Technical progress report, 9:50609 (R;US)

Vienna Univ. (Austria)
Algebra of two-component spinors. A revision, 9:50981 (R;AT;In German)
Gravitational field strength and generalized Komar-integral, 9:50976 (R;AT)
Ground state energy of an interacting bose gas, 9:50974 (R;AT)
Proton decay in the framework of a non-relativistic potential model, 9:50786 (R;AT)

Quantum field theory in gravitational background, 9:50704 (R;AT)
Semi-phenomenological approach to beauty-decay, 9:50787 (R;AT)
Solitons in solid state physics, 9:50973 (R;AT)
Static spin-3/2 perturbations of two-black hole system, 9:50705 (R;AT)
Stochastic quantization of the linearized gravitational field, 9:50975 (R;AT)
Structure of the periodic system, 9:50750 (R;AT)
Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Virginia Center for Coal and Energy Research
Prospects for coal in America's energy future, 9:49413 (R;US)
Vitro Corp., Silver Spring, MD (USA)
Solar energy system case study: Telex Communications, Blue Earth, Minnesota, 9:49691 (R;US)
Survey of remote data monitoring systems, 9:49692 (R;US)
Vitro Labs., Silver Spring, MD (USA)
Actual versus design performance of solar systems in the National Solar Data Network, 9:49694 (R;US)
Component report performance of solar collector arrays and collector controllers in the National Solar Data Network, 9:49693 (R;US)

W

Washington State Energy Office, Olympia (USA)
Solar collection, 9:49696 (R;US)
Washington State Univ., Pullman (USA). Nuclear Radiation Center
Organic and inorganic mercury species in the Ft. Lewis solvent refined coal pilot plant water treatment process. Technical report, 9:49361 (R;US)
Washington Univ., Seattle (USA)
Oxidation of volatiles in residential wood burning equipment. Final technical report, September 1980-February 1984, 9:49589 (R;US)
Washington Univ., St. Louis, MO (USA)
Elemental advances of ultraheavy cosmic rays, 9:50700 (R;US)
Waste Management Group, Inc., White Plains, NY (USA)
Directions in low-level radioactive waste management. Low-level radioactive waste disposal: commercial facilities no longer operating, 9:49544 (R;US)
Wayne State Univ., Detroit, MI (USA)
Shot noise limited detection of OH using the technique of laser induced fluorescence, 9:50513 (R;US)
Western Research Inst., Laramie, WY (USA)
Investigation of tracer tests on the Western Research Institute 10-ton retort, 9:49496 (R;US)
Westinghouse Electric Corp., Pittsburgh, PA (USA). Nuclear Energy Systems Div.
Evaluation of low-cobalt alloys for hardfacing applications in nuclear components. Final report, 9:49803 (R;US)
Extended Fuel Burnup Demonstration Program. Summary final report, 9:49770 (R;US)
Westinghouse Research and Development Center, Pittsburgh, PA (USA)
Development of high-efficiency solar cells on silicon web. First quarterly progress report, April 20-July 15, 1984, 9:49610 (R;US)
Laser assisted deposition, 9:49618 (R;US)
Laser-assisted solar cell metallization processing. Quarterly report, March 13-June 12, 1984, 9:49609 (R;US)
Superconducting electronic film structures. Annual report 1 January-31 December 1983, 9:50360 (R;US)
Westminster Coll., New Wilmington, PA (USA)
House thermal envelope conservation optimization with respect to performance/economics, 9:49968 (R;US)
West Virginia Univ., Morgantown (USA). Dept. of Chemical Engineering
Sour water stripping of coal gasification waste water. Final report, 9:49386 (R;US)
Wheaton Coll., Norton, MA (USA)
Experiment to evaluate methods for estimating fossil fuel resources, 9:49444 (R;US)
Williams Bros. Engineering Co., Tulsa, OK (USA)
Study of pipeline applications of fuel cells. Final report, 9:49961 (R;US)
Williams Companies, Tulsa, OK (USA)
Alaska Natural Gas Transportation System, 9:49485 (R;US)
Wisconsin Univ., Madison (USA)
Limits on soft X-ray flux from distant emission regions, 9:50691 (R;US)
Wisconsin Univ., Madison (USA). Dept. of Chemical Engineering
Microstructural analysis of ion containing polymers. Final report, July 1, 1981-June 30, 1984, 9:50175 (R;US)
Wisconsin Univ., Madison (USA). Dept. of Electrical and Computer Engineering
Simple transmission network planning method: Wisconsin power plant impact study, 9:49761 (R;US)
Wisconsin Univ., Madison (USA). Dept. of Nuclear Engineering
Wet wall cavity response in ICF reactors, 9:51032 (R;US)
Wisconsin Univ., Milwaukee (USA). Dept. of Mechanical Engineering
Geometric radiation exchange factors for axial radiative transfer in an LWR core filled with absorbing-emitting gases, 9:49852 (R;US)
Woodward-Clyde Consultants, Wayne, NJ (USA)
Subsidence monitoring in conjunction with methane gas production in Louisiana (phase 1, deep well program). Annual report November 1981-January 1983, 9:49481 (R;US)
Wyle Labs., Huntsville, AL (USA)
Extension of low coal canopy technology to include drilling and cutting machines. Open file report 19 December 1980-15 June 1983, 9:49417 (R;US)

Z

Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)
NIDAC - an on-line program for measurement and anlysis of gamma-ray emitting samples for environmental surveillance, 9:50543 (R;DD;In German)
Performance analysis of VVER-type fuel rods with the STOFFEL-1 computer code, 9:49778 (R;DD)
State and development of ion sources for accelerators, 9:50466 (R;DD;In German)

PERSONAL AUTHOR INDEX

Authors' surnames are indexed in the form appearing in the abstracted publication; given names are reduced to initials. Each author entry gives the publication title and the citation number. The document type, e.g., R for Report; country of publication, e.g., US; and language of the document, e.g., In German; are given in parentheses at the end of the entry. If no language statement appears, the language is English. Tables of document types and country of publication codes appear after the indexes. For publications with multiple authors, an entry is provided for each author. Entries for the second and succeeding authors give references to the first author.

Because of problems involved in the mechanical preparation of this index, all accent marks are omitted. Changes in spelling introduced as a result of accent omission follow standard conventions.

A

Aasen, R.K., Development of an advanced, microprocessor-based control subsystem for gas-fired, packaged cogeneration systems. Annual report February 1983-February 1984, 9:50059 (R;US)

Abe, K., Charm photoproduction at 20 GeV, 9:50770 (R;GB)

Achterberg, O., Model dependence of the determination of the strong coupling constant in second order QCD from e^+e^--annihilation into hadrons, 9:50774 (R;DE)

New data on semihadronic decays of the tau lepton, 9:50766 (R;DE)

Adams, J.H. Jr., Heavy ions in space (M0001), 9:50677 (R;US)

Adams, M.L., *See* Kochman, M.P., 9:49947

Adams, M.L. Jr., Large unbalance vibration analysis of steam turbine generators. Final report, 9:49746 (R;US)

Adeev, G.D., Description of recoil nuclei energy spectra for element analysis of materials, 9:50736 (RA;SU;In Russian)

Afzal, S.M.J., *See* Curtis, S.B., 9:50618

Agerstrand, T., Collecting well in fine sediment as heat storage for a block of flats in Karlstad. A preliminary study, 9:49967 (R;SE;In Swedish)

Aggarwal, R.L., *See* Wolff, P.A., 9:50389

Agnew, H.M., Civilian uses of nuclear power: status and future, 9:49790 (RA;US)

Ahluwalia, K.S., Operation and control of a solar molten salt steam generating system, 9:49675 (BA;US)

Ahmad, M.S., *See* Hayat, M.K., 9:50500

Ahmed, H., Electron beam processing of semiconductors, 9:50242 (BA;NL)

See Davis, J.R., 9:50241

See McMillan, G.B., 9:50238

Ahner, D., Farm and forest biomass - an energy source for Europe, 9:49611 (R;LU)

Aho, G.E., Results of the Bell Creek Unit "A" micellar-polymer pilot, 9:49452 (J;US)

Aichelburg, P.C., *See* Embacher, F., 9:50705

Ajuria-Garza, S., Mining-metallurgical projects for the production of uranium concentrates, 9:49507 (R;MX;In Spanish)

Akhtar, S., *See* Rogers, S.E., 9:49374

Alati, T., Role of histological techniques for preparation of bone in studies of Pu, 9:50610 (R;IT;In Italian)

Alberts, B.S., Incorporating energy conservation into the transportation planning process: mid-sized areas, 9:50030 (R;US)

Albrecht, H., Release of radioactivity and formation of aerosols during LWR core meltdown, 9:49881 (RA;DE;In German)

Albuyeh, F., Simple transmission network planning method: Wisconsin power plant impact study, 9:49761 (R;US)

Alden, M., Ignition probing by laser techniques. Preliminary experiments, 9:50077 (R;SE)

Aldred, A.T., *See* Nevitt, M.V., 9:50185

Alexander, G., *See* Maor, U., 9:50777

Alkasab, K.A., *See* Lu, C., 9:49965

Allemand, R., *See* Lander, G.H., 9:50493

Allen, B.J., *See* Wilson, D.J., 9:50279

Allen, R.D., Outcome of compressed air energy storage at Pittsfield, Illinois, 9:49904 (R;US)

See Kannberg, L.D., 9:49910

Allen, R.E., Technical reference book for the Energy Economic Data Base (EEDB) Program, 9:49791 (R;US)

Allen, S.L., Plasma-surface interactions in large tandem mirror devices - MFTF-B, 9:51009 (R;US)

Allison, K., *See* Provance, J., 9:49617

Allman, S.L., *See* Iturbe, J., 9:50339

Alsmeyer, H., Investigation in the BETA-test facility into the interaction between a core melt and concrete, 9:49868 (RA;DE;In German)

Alsmiller, F.S., Hadron-lepton cascade calculations (1-20 GeV) for a Pb-Al-lucite calorimeter, 9:50484 (R;US)

Alsmiller, R.G. Jr., Model of the world oil market with an OPEC cartel, 9:49461 (R;US)

See Alsmiller, F.S., 9:50484

Althaus, E., Mineralogical aspects of the production of geothermal energy, 9:49722 (TJ;US)

Althoff, M., Evidence for local compensation of baryon number in e^+e^- annihilation, 9:50764 (R;DE)

Experimental test of the flavor independence of the quark-gluon coupling constant, 9:50765 (R;DE)

Measurement of R and search for the top quark in e^+e^- annihilation between 39.8 and 45.2 GeV, 9:50763 (R;DE)

Aluisio, A.L., *See* Laurence, J.A., 9:50649

Alvarez, J.L., *See* Doyle, T.E., 9:49854

Alvin, M.A., *See* Mulik, P.R., 9:49343

Alzheimer, J.M., *See* Bampton, M.C.C., 9:49898

Ammirato, F.V., *See* Nemzek, T.A., 9:49933

Ammon, R.V., *See* Nagel, K., 9:49520

Amonett, C.M., *See* Kibbe, R.K., 9:51028

Amos, K., Analyses of electron and proton scattering to low excitation isoscalar states in ^{30}Ne, ^{24}Mg and ^{28}Si, 9:50856 (R;AU)

See Di Marzio, F., 9:50836

Anand, D.K., Cycle and system irreversibilities of solar powered absorption cooling, 9:49699 (BA;US)

Andersen, J.U., *See* Forster, J.S., 9:50892

Anderson, E.R., *See* Lambarski, T.J., 9:49641

Anderson, G.L., H_2S removal using mixed metal oxides and HCl removal using molten alkali carbonates, 9:49342 (RA;US)

Anderson, J.L., Instrumentation and Controls evaluation for space nuclear power systems, 9:49817 (R;US)

Anderson, L.D., Solar One turbine-generator, turbine 197845 start-up checklist, 9:49670 (R;US)

Anderson, R.M., *See* Reichert, J.D., 9:49713

Andersson, G., *See* Safinya, C.R., 9:50320

Ando, M., Experiment for triggered fragmentation with a molten copper-drop in water, 9:50401 (R;DE;In German)

Andrews, P.R., Location of 3p-3h strength in ^{16}N via the reaction ^{13}C(α,p)^{16}N at 118 MeV, 9:50842 (RA;AU)

Andrews, R.A., *See* Satti, J.A., 9:50468

See Theilacker, J., 9:50471

Ang, S.T., Computing building heat loads. A comparative survey of four heat load determination programmes. Final report, 9:50003 (R;NZ)

Angelini, P., *See* McHargue, C.J., 9:50159

See Sklad, P.S., 9:50158

Annen, K.D., *See* Stinespring, C.D., 9:49432

Annerskog, R., Lake water heat for a heating central at Kvarnberget, Falun, Sweden. Preliminary study, 9:50064 (R;SE;In Swedish)

Ansari, S.A., Mathematical formulation of temperature fluctuation and control

rod vibration in PARR, 9:49839 (R;PK)
Ansel'm, A.A., Long-range interaction related to exchange by massless Goldstone particles and methods of its detection, 9:50784 (RA;SU;In Russian)
Anthony, T.C., *See* Werthen, J.G., 9:49647
Apel, W.D., *See* Achterberg, O., 9:50766, 9:50774
Apostolov, T., Physical and mathematical models and computer codes for global reactor calculations of WWER, 9:49775 (RA;BG;In Bulgarian)
Apostolova, M, *See* Radicheva, M., 9:49828
Appelbaum, H.R., *See* Shirley, F.W., 9:49498
Appelman, E.H., Studies of the aqueous chemistry of fluorine and hypofluorous acid, 9:50306 (J;US)
Appert, K., *See* Kritz, A.H., 9:50989
Appleton, B.R., Morphological instabilities and ion beam mixing in Ge. Revision, 9:50099 (R;US)
See McHargue, C.J., 9:50160
See White, C.W., 9:50157
Arakawa, E.T., *See* Williams, M.W., 9:50183
Arendt, F., INTOR phase IIA, magnet system design - European contribution, 9:51034 (R;DE)
Arens, C., Investigations of the double plasma arc in a graphite tube, 9:50289 (R;DE;In German)
Argoud, M.J., *See* Dennison, E.W., 9:49705
Armijo, V.M., *See* Perrin, R.E., 9:50290
Armstrong, D., *See* Wright, S., 9:50046
Armstrong, J., *See* Rinard, G., 9:49755
Armstrong, J.A., Investigations into the emissions effects of vehicle misfueling, 9:50532 (R;US)
Arshad, M., Benchmark calculations for MTR type cores, 9:49841 (R;PK)
See Gul, S., 9:49781
Arthur, E.D., Applied nuclear data research and development. Semiannual progress report, April 1-September 30, 1983, 9:50824 (R;US)
See Young, P.G., 9:50902
Arya, R.R., Study of heterojunction solar cells based on n-CdS and several P-type semiconductors, 9:49612 (R;US)
Asghar, G., *See* Hussain, S.D., 9:50351
Ashley, J.C., *See* Williams, M.W., 9:50183
Assafiri, Y.I., Particle-hole description of the nuclear giant dipole resonance in light-to-medium nuclei, 9:50907 (RA;AU)
See O'Keefe, G.J., 9:50861
Atanasov, A., W K B approximation for solution of the quasipotential equation with a linear potential, 9:50781 (RA;BG;In Bulgarian)
Athans, M.T., Applications of CASCADE, 9:50376 (RA;US)
Athey, G.F., *See* Ramsdell, J.V., 9:50542
Atkielski, R., *See* Goldman, C., 9:49996
Atkins, H.M., *See* Paciorek, K.L., 9:49506
Attalla, A., *See* Bowman, R.C. Jr., 9:50163
Attenberger, S.E., *See* Houlberg, W.A., 9:51024
Atwood, C.L., User's guide to MIX: a computer code for fitting mixture distributions to data, 9:51051 (R;US)
Auerbach, N., Excitation of giant resonances in pion charge-exchange reactions, 9:50879 (J;FR)
Auvert, G., *See* Bensahel, D.D., 9:50243
Averback, R.S., *See* Rehn, L.E., 9:50105
Avigonne, F.T. III, *See* Moltz, D.M., 9:50867
Axton, R., *See* Noufi, R., 9:49629
Ayazuddin, S.K., *See* Ansari, S.A., 9:49839

B

Babcock, G.T., *See* Hanson, L.K., 9:50337
Bachovchin, D.M., *See* Mulik, P.R., 9:49343
Backman, A., Waste heat recovery from waste water with a heat pump for 400 flats in Falun. Project plan, 9:50063 (R;SE;In Swedish)
Bacon, T.C., *See* Abe, K., 9:50770
Badeva, V., *See* Tsvetanov, P., 9:49924
Badger, B., TASKA-M - a low cost, near term tandem mirror device for fusion technology testing, 9:51033 (R;DE)
Baer, H.W., *See* Bowman, J.D., 9:50878
Baerl, P., *See* Campisano, S.U., 9:50221
Bagaev, V.N., Unfolding of concentration profiles from backscattering energy spectra with allowance for some distortion factors, 9:50742 (RA;SU;In Russian)
Bahr, C.C., *See* Liu, G., 9:50746
Bahr, D., *See* Foote, J.H., 9:50680
Bahrami, K., *See* Krauthamer, S., 9:49654
Bajer, V.N., Emission spectrum at electron plane channeling with account for dechanneling and collimation, 9:50197 (RA;SU;In Russian)
Radiation at planar channeling of relativistic electrons in thick crystals, 9:50954 (RA;SU;In Russian)
Bakalyar, D.M., Shot noise limited detection of OH using the technique of laser induced fluorescence, 9:50513 (R;US)
Baker, C.C., *See* Jung, J., 9:51043
Baker, D.R., *See* Moser, H., 9:50656
Baker, E.G., Gasification of biomass for the production of methanol and ammonia, 9:49587 (R;US)
See Brown, M.D., 9:49586
Baker, G.G., Coal-water slurry preparation, 9:49421 (RA;US)
Baker, R.M., Thalweg disposal: demonstration of an alternative, 9:50567 (R;US)
Bakhtyar, S., Calculations of K with burn-up for various enrichments for MTR type core, 9:49842 (R;PK)
Bakos, J.S., Transition scattering and transition bremsstrahlung in a dense plasma - a step towards soft x-ray lasers, 9:51008 (R;HU)
Ball, J.B., *See* Young, G.R., 9:50443
Ballam, J., *See* Abe, K., 9:50770
Ballard, E.O., Purged window apparatus utilizing heated purge gas, 9:49366 (P;US)
Ballou, J.E., Toxicology of ^{85}Kr: chronic exposure studies, 9:50620 (J;GB)
Baltisberger, R.J., Synthesis of oligomeric models of coal derived materials for use with GPC calibration. Quarterly report, June 1984-September 1984, 9:49353 (R;US)
Bamberger, C.E., *See* Brynestad, J., 9:50166
Bampton, M.C.C., Pipe to pipe impact, 9:49898 (R;US)
Ban, T.E., *See* Marlowe, W.H., 9:49433
Banal, M., Quantum relativity theory, 9:50963 (R;HU)
Bandoli, G., Isothiocyanato complex of technetium(II). Spectroelectrochemical and single-crystal x-ray structural studies on trans-[Tc(DPPE)$_2$(NCS)$_2$]^0, where DPPE = 1,2-bis(diphenylphosphino)ethane, 9:50354 (J;US)
Bankova, S., *See* Atanasov, A., 9:50781
Banks, S.M., ^{48}Ca(d,^{3}He)^{47}K reaction at 80 MeV, 9:50863 (RA;AU)
Barak, J., *See* Raizman, A., 9:50113
Barbato, E., *See* Santini, F., 9:50998
Barbee, T.W., *See* Day, R.H., 9:50498
Barbier, D., Pulsed electron beam annealing induced deep level defects in virgin silicon, 9:50232 (BA;NL)
Barendsen, G.W., Dose limits for radiological workers, 9:50936 (RA;NL;In Dutch)
Radiobiological basis of radiation hygiene, 9:50612 (RA;NL;In Dutch)
Bark, R., *See* Stuchbery, A.E., 9:50889
Barker, F.C., E1 decay of the first excited state of ^{9}Be, 9:50837 (RA;AU)
See Woods, C.L., 9:50835
Barna, B.A., Modeling of real UT transducer field/flaw interactions, 9:50410 (R;US)
Barr, J.M. Jr., Vepco's Alternative Energy Study: incorporating and assessing energy conservation as a part of utility planning and goal formulation, 9:50039 (RA;US)
Barr, Th.A. Jr., *See* Holl, H.B., 9:50396
Barraclough, B.L., *See* Elliott, G.R.B., 9:49483
Barron, L.S., *See* Ettensohn, F.E., 9:49493
See Robl, T.L., 9:49492
Barrows, R.D., *See* Franz, J.A., 9:50324
Barth, D.S., Soil sampling quality assurance user's guide, 9:50552 (R;US)
Barth, J.M., *See* Stassinopoulos, E.G., 9:50695
Barthels, H., Effective thermal conductivity in packed beds of spheres especially in the core of a high temperature reactor, 9:49780 (R;DE;In German)
Bartke, E., Application of holography in trace detectors of high resolution, 9:50478 (RA;BG;In Bulgarian)
Bartle, C.M., Measurements of angular distributions for the ^{6}Li(n,t)^{4}He reaction in the MeV region, 9:50838 (RA;AU)
Barton, J.J., *See* Liu, G., 9:50746
Barz, H.W., Hydrodynamical description of the quark-gluon plasma formation in heavy-ion collisions at intermediate energies, 9:50913 (R;HU)
Baseman, R.J., Reactive scattering of O(^{3}P) with toluene, 9:50321 (J;US)
Baskes, M.I., *See* Daw, M.S., 9:50143
Batchelor, D.A., Energetic electrons in impulsive solar flares, 9:50696 (R;US)
Batchelor, D.B., Comparison of electron cyclotron heating theory and experiment in EBT, 9:51001 (R;US)
Bates, H.E., *See* Jewett, D.N., 9:49633
Batra, R.C., *See* Passman, S.L., 9:51061
Batsche, H., *See* Moser, H., 9:50656

Baudry, T.V., *See* Gray, W.H., 9:51023
Bauer, G.S., DIANE-a project for a new high performance neutron source in the Federal Republic of Germany, 9:50462 (RA;SU)
Bauerle, W.L., Conserving energy in Ohio glass greenhouses. Final report, March 1, 1978-December 31, 1980, 9:50000 (R;US)
Bauhoff, W., Comment on '(p,n) and (n,p) reactions as probes of isovector giant monopole resonances', 9:50917 (R;AU)
Medium corrections in inelastic proton scattering at intermediate energies, 9:50911 (RA;AU)
See Amos, K., 9:50856
Baumgartner, M., *See* Olson, D.L., 9:50482
Baxter, A.M., *See* Burnett, M., 9:50874
See Vermeer, W.J., 9:50841
Bean, V.E., High pressure liquid level monitor, 9:49424 (P;US)
Beauchamp, J.L., *See* Schultz, J.C., 9:50357
Beavis, L.C., *See* Gerwin, H.J., 9:49717
Bechtold, W.E., Chemical and biological properties of diesel exhaust particles collected during selected segments of a simulated driving cycle, 9:50640 (J;US)
Beck, S.R., Economic feasibility of cattle manure as a chemical feedstock, 9:49588 (BA;US)
Becker, E.W., Accuracy of X-ray lithography using synchrotron radiation for the fabrication of technical separation nozzle elements, 9:49511 (R;DE;In German)
Becker, F., *See* Arendt, F., 9:51034
Becker, F.L., *See* Nemzek, T.A., 9:49933
Becker, H., Failure of a large cryogenic MHD magnet, 9:51040 (J;FR)
Insulation systems engineering, 9:51039 (J;FR)
Becker, K.M., Experimental investigation of post dryout heat transfer, 9:49885 (R;SE)
Becker, W.G., *See* Jones, G. II, 9:50343
Becla, P., *See* Wolff, P.A., 9:50389
Bednarik, K., Analysis of selected operating modes in WWER 440 nuclear power plants, 9:49823 (RA;CS;In Czech)
Beene, J.R., *See* Bertrand, F.E., 9:50880
Beg, M.M., *See* Hayat, M.K., 9:50500
Behravesh, M., *See* Nemzek, T.A., 9:49933
Behrens, Some connections between the efficiency degree of combustion engines and the fuel consumption of the vehicle, 9:50075 (RA;DD;In German)
Behrens, H., *See* Moser, H., 9:50656
Behrisch, R., Plasma surface interaction processes and possible synergisms, 9:51026 (R;US)
Bell, Z.W., Use of the analytic signal in ultrasonic imaging, 9:50417 (R;US)
Bellinghausen, B., Measurement of coherent π^0 photoproduction on ^{3}He and ^{3}H in the resonance region, 9:50828 (R;DE)
Benda, B.J., *See* Johnson, J.J., 9:49902
Benedict, R.G., *See* Allen, R.E., 9:49791
Benes, S., Microelements '80. Conference proceedings, 9:50267 (R;CS;In Czech and Slovak)
Benjaballah, N., *See* Schueck, C., 9:50896
Benker, D.E., *See* King, L.J., 9:50350
Benner, J., Fluid-structure-interaction of the pressurized water reactor core internals during blowdown - numerical simulation with a homogenization model, 9:49883 (R;DE;In German)
See Geiss, M., 9:49879
Bennett, D.W., *See* Spicer, L.D., 9:50292
Beno, M.A., Synthetic metals based on tetramethyltetraselenafulvalene(TMTSF): varied anisotropy in the low temperature (125K) structures of $(TMTSF)_2X$, X = ClO_4^-, PF_6^-, and AsF_6^-, 9:50315 (J;GB)
Bensahel, D.D., Explosive crystallization in a-Ge and a-Si: a review, 9:50243 (BA;NL)
Benson, D.A., *See* Russo, A.J., 9:50139
Benson, R.D., *See* Kibbe, R.K., 9:51028
Benson, S.A., Distribution of inorganics, 9:49380 (RA;US)
Bensoussan, M., *See* Moison, J.M., 9:50252
Bent, B.E., *See* Somorjai, G.A., 9:50744
Bentini, G.G., Analysis of temperature and stress profiles induced by a CW line scanned electron beam in <100> oriented silicon, 9:50249 (BA;NL)
Bentley, J., *See* Sklad, P.S., 9:50158
Benton, E.V., Linear energy transfer spectrum measurement experiment (P0006), 9:50679 (R;US)
See Frank, A.L., 9:50485
Bentsen, L.D., Effect of crystallization of the grain-boundary phase on the thermal diffusivity of a sialon ceramic, 9:50167 (J;US)
Bentz, R.R., *See* Stoughton, R.S., 9:49516
Berends, F.A., Multiple bremsstrahlung in gauge theories at high energies. Pt. 3, 9:50772 (R;DE)
Multiple bremsstrahlung in gauge theories at high energies. Pt. 4, 9:50773 (R;DE)
Berge, L., Spin dependent effects in pion-nucleus scattering, 9:50910 (RA;AU)
Berger, C., Measurement of the photon structure function $F_2sup(\gamma)(x,Q^2)$, 9:50767 (R;DE)
Berger, J.D., *See* Yount, J.A., 9:50367
Bergeron, E.D., *See* Reed, A.W., 9:49899
Bergman, R.C., *See* Rich, J.W., 9:50393
Berlin, R.E., Directions in low-level radioactive waste management. Low-level radioactive waste disposal: commercial facilities no longer operating, 9:49544 (R;US)
Berman, B.L., *See* Zubanov, D., 9:50843
Berman, M., Light water reactor hydrogen safety research in the United States, 9:49865 (RA;DE)
Bernabei, S., *See* Motley, R., 9:50999
Bernard, M., Numerical simulation of current drive by lower hybrid waves, 9:50990 (RA;GB)
Berndt, E.R., Energy demand in the transportation sector of Mexico, 9:49944 (R;US)
Bernecker, G., Proof of the fracture resistance of the pipes in the THTR 300 plant using high temperature burst tests with X 20 CrMoV 12 1 components, 9:50117 (RA;DE;In German)
Berry, F.O., *See* Anderson, G.L., 9:49342
Berry, G.F., Direct-contact closed-loop heat exchanger, 9:50406 (P;US)
Berry, S.D., *See* Sellin, I.A., 9:50725
Bers, A., *See* Hewett, D., 9:50987
Bersillon, O., Transformation of angular scattering probabilities between reference systems: survey and numerical analysis, 9:50827 (R;XN)
Bertolotti, M., Interferometric measurements of surface properties during laser annealing, 9:50251 (BA;NL)
Bertrand, F.E., Heavy ion excitation and photon decay of giant resonances, 9:50880 (J;FR)
Berwald, D.H., *See* McCarville, T.J., 9:51036
Besmann, T.M., *See* Stinton, D.P., 9:50173
Beverly, C.R., Quantitative determination of uranium discharges in vent stack gases, 9:49565 (R;US)
Beverly, W.D., Small Brayton central receiver systems for remote industrial power generation, 9:49676 (BA;US)
Beyer, C.E., *See* Cunningham, M.E., 9:49816
Bhattacharya, P.K., Transport properties of n-type metalorganic chemical-vapor-deposited Al/sub x/Ga/sub 1-x/As (0< or =x< or =0.6), 9:50213 (J;US)
Bhumralkar, C.M., *See* Ruff, R.E., 9:50528
Biefeld, R.M., *See* Gourley, P.L., 9:50206
Biegelsen, D.K., Laser-induced crystallization of silicon on bulk amorphous substrates: An overview, 9:50226 (BA;NL)
Biegelson, D.K., *See* Nemanich, R.J., 9:50219
Bienfang, P.K., Temporal and spatial variability of phytoplankton in a subtropical ecosystem, 9:50565 (J;US)
Bier, R.E., *See* Jory, H.R., 9:51035
Bigelow, J.E., *See* King, L.J., 9:50350
Billmayer, H., Extension of low coal canopy technology to include drilling and cutting machines. Open file report 19 December 1980-15 June 1983, 9:49417 (R;US)
Binet, B., *See* Lemal, B., 9:49580
Bingham, G.E., *See* Coyne, P.I., 9:50648
Bircher, C., Specification and cost manual for energy retrofits on small commercial and multifamily buildings, 9:49690 (R;US)
Bird, J.R., Nuclear reaction analysis profiling, 9:50281 (RA;AU)
Birdwell, J.D., Appropriate implementation languages, 9:50378 (RA;US)
Executive summary, 9:50375 (RA;US)
Software tools, 9:50380 (RA;US)
Biringer, K.L., *See* Burgess, E.L., 9:49660
Birkmire, R.W., *See* Phillips, J.E., 9:49639
Bishop, S.G., Studies of hydrogenated amorphous silicon, 9:49627 (R;US)
Black, H.L., *See* Hill, V.L., 9:49370
Blackwell, A., *See* Saunders, D.H., 9:49409
Blair, H.T., Pump for metering high-level waste and glass former mixtures to an electric melter, 9:49555 (R;US)
Blakely, E.A., *See* Tobias, C.A., 9:50627
Bland, A.E., Geochemistry of Mississippian and Devonian oil shales of northeastern Kentucky, 9:49494 (J;US)
See Robl, T.L., 9:49492
Bland, I.D., *See* Taylor, K.J., 9:49532
Bland, L.C., *See* Morris, C.L., 9:50847
Blander, M., *See* Curtiss, L.A., 9:50314

See Saboungi, M.L., 9:50312
Biasiole, G.A., Heat exchanger for coal gasification process, 9:49364 (P;US)
Bley, P., *See* Camara, A.S., 9:49510
Blind, D., *See* Maidorn, C., 9:50411
Blommaert, W., *See* Gijbels, R., 9:49724
Blomquist, B.W., *See* Filby, R.H., 9:49361
Blomqvist, L., *See* Liem, H., 9:49398
Bloom, E.T., *See* Makinodan, Takashi, 9:50609
Bludovsky, R., *See* Duchacek, V., 9:50269
Bluhm, S., Advanced cogeneration research study. Executive summary, 9:49939 (R;US)
Bly, S.A., Graphics capabilities, 9:50379 (RA;US)
Bocola, W., *See* Tassoni, E., 9:49550
Boegly, W.J. Jr., Assessment of research and development for the management of fossil energy-related solid wastes, 9:49399 (R;US)
Grouting of uranium mill tailings piles, 9:49541 (R;US)
See Watson, J.S., 9:49384
Boenig, H.J., Tests of the 30 MJ superconducting magnetic energy storage unit, 9:49903 (J;FR)
Boes, E.C., Photovoltaic concentrator progress, 9:49716 (BA;US)
Boettcher, D., Detrimental effects of subsequent increases in the safety and quality requirements using the Grohnde nuclear power station as an example, 9:49857 (RA;DE;In German)
Boettcher, R.J., Ultrathin GaAs and AlGaAs solar cells, 9:49652 (BA;US)
Bogoeva, L., *See* Radicheva, M., 9:49828, 9:49829, 9:49830
Bohi, D.R., Oil supply disruptions and the role of the International Energy Agency, 9:49459 (R;US)
Bohm, A., Consistency between two recent experiments on $\Sigma^- \rightarrow n e \nu$, 9:50771 (J;US)
Boie, R.A., *See* Fischer, J., 9:50489
Bokor, J., *See* Bucksbaum, P.H., 9:50223
Boldeman, J.W., *See* Walsh, R.L., 9:50904
Boldt, K.R., *See* Reed, A.W., 9:49899
Bollinger, D., Dry etching of metallization, 9:50422 (R;US)
Bolotin, H.H., *See* Ryan, C.G., 9:50884
See Stuchbery, A.E., 9:50889
Bolton, P.A., *See* Cluett, C., 9:49558
Bondietti, E.A., *See* Lindberg, S.E., 9:50522
Bonell, P.G., *See* Debenham, A.A., 9:49900
Bonoli, P.T., *See* Englade, R.C., 9:50991
Booker, C., *See* Steinke, R., 9:49886
Booker, S.R., NBS frequency measurement system from a user's viewpoint, 9:50502 (R;US)
Borchardt, G., Fundamentals for the evaluation of irradiation experiments on enrichment reduction in the FRJ-2 (AF-Programme), 9:49837 (R;DE;In German)
Borden, P.G., V-Groove silicon solar cell, 9:49638 (BA;US)
See Boettcher, R.J., 9:49652
Borgstroem, H., *See* Alden, M., 9:50077
Bork, G., Status of the reactor safety research in the Project Nuclear Safety, 9:49878 (RA;DE;In German)
Born, J.L., *See* Woodruff, K.H., 9:50626
Bornschein, R., Retention of incorporated radionuclides after variable application of gamma-rays, 9:50614 (R;DE;In German)
Bosch, M.A., *See* Lemons, R.A., 9:50230
Boshkova, T., *See* Manushev, B., 9:50578
Botero, G., *See* Berndt, E.R., 9:49944
Bottcher, C., *See* Sellin, I.A., 9:50725
Bouree, J.E., Impurity diffusion in silicon annealed by semi-continuous laser, 9:50250 (BA;NL)
Bourke, P.J., Programme of research into the management and storage of radioactive waste. Single fracture experiment at Chalk River. Annual progress report for 1983, 9:49533 (R;GB)
Bowles, C.J., *See* Fardy, J.J., 9:50273
Bowman, J.D., Dependence of the excitation energy, width, and cross section of the isovector monopole resonance, 9:50878 (J;FR)
Bowman, R.C. Jr., Properties and thermal stabilities of amorphous transition metal hydrides, 9:50163 (R;US)
Bowsher, C.A., Further actions needed to improve emergency preparedness around nuclear powerplants, 9:49855 (R;US)
Legislative changes are needed to authorize emergency federal coal leasing, 9:49437 (R;US)
Status of Bonneville Power Administration's efforts to improve its oversight of three nuclear power projects, 9:49792 (R;US)
Boy, E.G., Investigation of optimal aimpoints for multiple nuclear weapons against installations in a target complex. Master's thesis, 9:50507 (R;US)
Boyadzhiev, L., *See* Rajchev, Kh., 9:50413
Boyce, P.R., Uplighting design guide, 9:50007 (R;GB)
Bradbury, J.N., Proceedings of the seventeenth LAMPF Users Group meeting, 9:50446 (R;US)
Bradbury, M.H., Programme of research into the management and storage of radioactive waste. Aqueous phase transport through granitic rocks. Annual report 1983, 9:49531 (R;GB)
Braginski, A.I., Superconducting electronic film structures. Annual report 1 January-31 December 1983, 9:50360 (R;US)
Braithwait, S.D., Residential load forecasting: intergrating end-use and econometric methods, 9:49983 (RA;US)
Braun, S., *See* Falcone, S., 9:49431
Braunschweig, W., *See* Althoff, M., 9:50763, 9:50764, 9:50765
Breault, R.D., Phosphoric acid electric utility fuel cell technology development. Technical progress report No. 13, 9:49962 (R;US)
Brecht, S.H., Study of field aligned plasma acceleration during a HANE (High Altitude Nuclear Explosion). Technical report, 9:50511 (R;US)
Breckwoldt, E., *See* Schmidt, T., 9:50122
Breidung, P., Alternating-pressure underground gasification, 9:49367 (TG;US)
Breinig, M., *See* Sellin, I.A., 9:50725
Breitenstein, B.D. Jr., Report of an accidental acute human exposure to ^{241}Am, 9:50624 (J;US)
Brejcha, M., Autos 82. Volume 2. Automation in engineering, 9:50358 (R;CS;In Czech)
Autos 82. Volume 4. Automation in engineering, 9:50369 (R;CS;CZ)
Autos 82. Volume 1. Automation in engineering, 9:50370 (R;CS;CZ)
Autos 82. Volume 3. Automation in engineering, 9:50371 (R;CS;CZ)
Brengle, T.A., Simulating field-reversed magnetic-mirror fusion devices, 9:51013 (J;US)
Brenig, H., *See* Thomas, W., 9:49793
Brennan, J.E., Evolution of demand-side planning at PG and E, 9:50038 (RA;US)
Brenner, R., *See* Strauss, M.G., 9:50488
Bretano, P. von, Collective states in transitional nuclei, 9:50871 (RA;BG)
Breunlich, W.H., Experimental study of muon-catalyzed fusion in low-density deuterium-tritium gas, 9:50752 (J;US)
Bridwell, P.M., *See* Rosenow, M.K., 9:50597
Briggs, R.L., *See* Zaremski, D.R. Jr., 9:49624
Briggs, T.A., *See* Breault, R.D., 9:49962
Brimhall, J.L., Amorphous phase formation in irradiated intermetallic compounds, 9:50138 (R;US)
Bristline, R.W., *See* Dagle, G.E., 9:50621
Broadhead, R.F., Stratigraphically controlled gas production from Abo red beds (Permian), east-central New Mexico, 9:49475 (R;US)
Brock, B.C., *See* Reichert, J.D., 9:49713
Brody, C.W., *See* Marlowe, W.H., 9:49433
Broecker, W.S., *See* Peng, T.H., 9:50655
Brogden, I., Metals and Ceramics Division progress report for period ending June 30, 1984, 9:50093 (R;US)
Brooks, C., *See* Jalan, V., 9:49338
Brosey, W.D., Ultrasonic analysis of spherical composite test specimens, 9:50416 (R;US)
Ultrasonic girth weld evaluation for aluminum substrate of spherical Kevlar-epoxy test specimens, 9:50418 (R;US)
Brosset, C., Mercury species present in smoke from coal fire. Water soluble mercury species in air and precipitation, 9:50530 (R;SE;In Swedish)
Brostroem, C.E., *See* Olausson, L., 9:49406
Broutet, F., *See* Fogarassy, E., 9:50222
Brown, C.O., Slag capture and removal during laser cutting, 9:50147 (P;US)
Brown, G.E., *See* Glover, R.L., 9:50438
Brown, G.M., *See* Vallet, C.E., 9:50329
Brown, G.W., Designing for fatigue with random vibration excitation, 9:50415 (R;US)
Brown, I.G., Effect of resonant microwave power on a PIG ion source, 9:50743 (R;US)
Brown, M.D., Catalysts for gasification of biomass, 9:49586 (R;US)
See Baker, E.G., 9:49587
Brown, P.A., Identification and characterization of major structural discontinuities within the Eye-Dashwa lakes granite, Atikokan, N.W. Ontario, 9:50658 (RA;CA)
Brown, R.A., Thermal migration of tin into gallium arsenide, 9:50284 (RA;AU)

Brown, S.D., *See* Nemzek, T.A., 9:49933
Broyde, S., Conformations of DNA adducts with polycyclic aromatic carcinogens, 9:50587 (R;US)
Brueck, S.R.J., *See* Tsaur, B.Y., 9:50231
Bruegmann, J., *See* Fries, S., 9:49736
Brun, T.O., Defects and disorder in the fast-ion electrode lithium-aluminum, 9:49915 (J;US)
Bryan, J.B., Power of deterministic thinking in machine tool accuracy, 9:50382 (R;US)
Brynestad, J., Method for removing oxide contamination from titanium diboride powder, 9:50166 (P;US)
Bube, R.H., *See* Werthen, J.G., 9:49647
Buchanan, A.C., *See* Smith, G.P., 9:50313
See Zingg, S.P., 9:50327
Buchanan, A.D., Influence of redox and Lewis acid functions of $SbCl_5$-rich molten salt catalysts on the reactions of coal model compounds, 9:50326 (J;US)
Buchanan, R.A., *See* Williams, J.M., 9:50590
Buckley, T., *See* Frischknecht, F.C., 9:50664
Bucksbaum, P.H., Measurement of fast melting and regrowth velocities in picosecond laser heated silicon, 9:50223 (BA;NL)
Budnik, E.Y., *See* Pissarenko, N.F., 9:50683
Bugrov, V.N., Simulation of nuclear reaction duration on measurement at substantial radiation damage of monocrystal, 9:50127 (RA;SU;In Russian)
Bujak, A., *See* Hirsch, A.S., 9:50868
Bulgakov, Yu.V., Resonant dechanneling of hundreds keV hydrogen and helium ions at axial-plane transitions in silicon, 9:50196 (RA;SU;In Russian)
Bunnell, R.E., BRIK, an interactive, goal programming model for nuclear exchange problems. Master's thesis, 9:50508 (R;US)
Burch, D.M., *See* Gujral, P.S., 9:49689
Burenkov, A.F., Dependence of characteristic X-radiation emission effective depth from type of dechanneling differential function, 9:50124 (RA;SU;In Russian)
Burgener, M.L., Temperature profiles induced by strip heaters, 9:50248 (BA;NL)
Burger, D.R., Getting the current out, 9:49615 (R;US)
Burgess, E.L., Design and installation experiences from nine intermediate-sized photovoltaic systems: a critical analysis, 9:49660 (BA;US)
Burgess, V.E., Demonstration of furnace curtains to reduce heat energy. Final report, 9:50054 (R;US)
Burghardt, M., *See* Sellin, I.A., 9:50725
Burke, F.P., *See* Kleinpeter, J.A., 9:49375
Burkett, J.P., *See* Nuckovich, M., 9:50426
Burkhardt, J., *See* Haubelt, R., 9:50560
Burlaga, L.F., *See* Whang, Y.C., 9:50689
Burlitch, J.M., *See* Sienko, M.J., 9:50182
Burnett, M., Octupole-vibrational states in the even mass isotopes of barium, 9:50874 (RA;AU)
Burnett, R., *See* Wakefield, R.A., 9:49961
Burnett, S.M., *See* Vermeer, W.J., 9:50841
Burr, L., *See* Wong, S., 9:50394
Burrows, D.N., Limits on soft X-ray flux from distant emission regions, 9:50691 (R;US)
Burrows, T.W., *See* Chrien, R.E., 9:50819
Burton, H.D., Integration of an automated library support system with an intelligent gateway, 9:51063 (R;US)
Buschow, K.H.J., *See* Gubbens, P.C.M., 9:50751
Bush, J., *See* Aho, G.E., 9:49452
Buss, R.J., *See* Baseman, R.J., 9:50321
Busse, L.J., Emerging technology of synthetic aperture focusing for ultrasonic testing, 9:49814 (R;US)
Bussey, P.J., *See* Berger, C., 9:50767
Bustad, T., *See* Annerskog, R., 9:50064
Butkovich, T.R., *See* Patrick, W.C., 9:49560
Butler, J.W., Selected topics in surface analysis by high-energy ion beams, 9:50287 (RA;AU)
Butler, W.H., Resistivity of alloys, 9:50946 (R;US)
Butner, R.S., *See* Sealock, L.J. Jr., 9:49357
Buttler, R., *See* Mueller, R., 9:49569
Buydens, C., *See* Schepens, G., 9:49960
Byer, R.L., Solid-state laser sources for remote sensing, 9:50519 (BA;NL)
Tunable optical sources. Final report 20 February 1981-19 February 1984, 9:50388 (R;US)
Byers, K.R., Safeguards and security design guidelines for conceptual monitored retrievable storage (MRS) facilities, 9:49571 (R;US)
Byrne, A.P., Alignment of neutrons and protons in rotating $^{190\ 192\ 194}Hg$ nuclei, 9:50900 (RA;AU)
High spin states in Fr nuclei, 9:50901 (RA;AU)
See Davies, R.F., 9:50899

C

Cable, J.W., *See* Wong, P., 9:50308
See Wong, P.Z., 9:50942
Cacciuffo, R., *See* Pinto, H., 9:50114
Cahen, D., n-$CuInSe_2$ based photoelectrochemical cells: Improved, stable performance in aqueous polyiodide through rational surface and solution modifications, 9:49628 (J;US)
Cahill, R.T., *See* Williams, A.G., 9:50805
Calder, I.D., Selective laser annealing for device processing, 9:50235 (BA;NL)
Calhoun, R.C., Great PG and E energy rebate, 9:50051 (RA;US)
Callaghan, W.T., Flat-plate solar array progress and plans, 9:49715 (BA;US)
Callahan, P.M., *See* Hanson, L.K., 9:50337
Calvert, S., *See* Jain, R., 9:49392
See Yung, S.C., 9:49402
Calvin, M., *See* Otvos, J.W., 9:50335
Camaioni, D.M., *See* Franz, J.A., 9:50324
Camara, A.S., Investigations into the operating behavior of separation nozzle cascades for uranium-235 enrichment in a 10-stage pilot plant, 9:49510 (R;DE;In German)
Campbell, D., *See* Sondericker, J.H., 9:50472
Campbell, R.B., Effect of radial transport on tandem mirror end loss, 9:51012 (J;GB)
See Rohatgi, A., 9:49610
Campisano, S.U., Impurity redistribution in ion implanted Si after picosecond Nd laser pulse irradiation, 9:50221 (BA;NL)
Canada, D.C., *See* Russell, D.H., 9:50338
Canobbio, E., Interpretation of LH current drive experiments, 9:50988 (RA;GB)
rf current drive in the presence of a dc electric field, 9:50993 (RA;GB)
Canon, R.M., *See* Boegly, W.J. Jr., 9:49399
See Watson, J.S., 9:49384
Cantrell, J.S., *See* Bowman, R.C. Jr., 9:50163
Canty, M.J., *See* Mueller, R., 9:49569
Cappelli, J.R., Integrating dosimeter for pulsed radiation, 9:50476 (R;US)
Caput, B., *See* Bersillon, O., 9:50827
Cargnelli, M., *See* Breunlich, W.H., 9:50752
Carlisle, N., *See* Bircher, C., 9:49690
Carlos, W.E., *See* Bishop, S.G., 9:49627
Carlson, R.C., *See* Patrick, W.C., 9:49560
Carmichael, D.C., Cost analyses of modular flat-panel and concentrator photovoltaic array fields, 9:49659 (BA;US)
Carne, A., *See* Liem, H., 9:49398
Carpaij, W.J.M., Industrial doctor and radiation hygiene at ECN, 9:50937 (RA;NL;In Dutch)
Training of medical radiation experts for the occupational health services, 9:50939 (RA;NL;In Dutch)
Carpenter, R.L., *See* Cheng, Y.S., 9:50535
Carr, D.B., Organizational tools for data analysis environments, 9:51060 (R;US)
See Nicholson, W.L., 9:51059
Carrasco, A.H., Exposition index calculation from different points in a gamma sterilization plant radiation room, 9:50935 (R;MX;In Spanish)
Carruthers, P., Collective, stochastic and nonequilibrium behavior of highly excited hadronic matter, 9:50920 (J;NL)
Carson, K.R., *See* Mckee, W.R., 9:49677
Carter, C.D., *See* King, G.B., 9:50356
Carter, N.L., *See* Handin, J., 9:50665
Casavecchia, P., *See* Baseman, R.J., 9:50321
Caspari, G., Diesel engine for with and without supercharging, 9:50071 (RA;DD;In German)
Cass, T.R., *See* Zorabedian, P., 9:50224
Casson, W.H., Far-infrared laser diagnostic on EBT and extreme far-forward laser scattering on ISX, 9:51002 (R;US)
Cassulo, J.C., *See* Gabor, J.D., 9:49851
Casten, R.F., Intrinsic excitations in deformed nuclei. Characteristic predictions of the IBA, 9:50895 (BA;JP)
Casti, T.E., *See* Otvos, J.W., 9:50335
Castrigiano, D.P.L., Repeated measurements in quantum theory, 9:50969 (R;DE)
Catalano, A., Attainment of 10 percent conversion efficiency in amorphous silicon solar cells, 9:49651 (BA;US)
Cave-Bondi, G., Plutonium contamination in Italian population, 9:50611 (R;IT;In Italian)

Celler, H.K., Lateral epitaxial growth of thick polysilicon films on oxidized 3-inch wafers, 9:50229 (BA;NL)
Cerini, J., *See* O'Brien, P.M., 9:50277
Chaiken, R.F., *See* Dalverny, L.E., 9:49415
Chamberlain, H.E., Laboratory techniques for safe encapsulation of α-emitting powder samples, 9:50363 (R;GB)
Chamberlin, E.P., *See* York, R.L., 9:50463
Chan, D.W.S., *See* Sheldon, E., 9:50925
Chan, S.H., Geometric radiation exchange factors for axial radiative transfer in an LWR core filled with absorbing-emitting gases, 9:49852 (R;US)
Chan, S.K., *See* Nevitt, M.V., 9:50185
Chan, V.S., Minority ICRF current drive in toroidal geometry, 9:50983 (RA;GB)
Nonlinear theory of lower hybrid current drive - a two-dimensional Fokker-Planck study, 9:50986 (RA;GB)
Chandra, J., Coupled nonlinear oscillators, 9:50387 (B;NL)
Chang, C.K., *See* Hanson, L.K., 9:50337
Chang, J., Photonic methods of high speed analog data recording, 9:50501 (R;US)
Chang, M.J., *See* Roux, J.A., 9:49704
Chang, P.Y., *See* Tobias, C.A., 9:50627
Chang, R., Dust filtration using ceramic fiber filter media: a state-of-the-art summary, 9:49395 (RA;US)
Chang, R.R., *See* Hotchkiss, G.B., 9:49655
Chantre, A., *See* Barbier, D., 9:50232
Chapman, D.M., Electrochemical properties of the solvent $SbCl_3$-$AlCl_3$-N-(1-BUTYL)pyridinium chloride and electrochemical and spectroelectrochemical studies of the solute 9,10-dimethylanthracene, 9:50325 (J;US)
See Zingg, S.P., 9:50327
Chapman, L., *See* Theilacker, J., 9:50470
Chapman, R.L., *See* Tsaur, B.Y., 9:50231
Chappell, J.R., *See* Rinehart, B.N., 9:49592
Charity, R.J., Heavy ion induced fission reactions, 9:50891 (RA;AU)
See Chatterjee, A., 9:50883
Charles, D.D., *See* Thomas, B.J., 9:50280
Charlot, L.A., *See* Brimhall, J.L., 9:50138
Chastagner, P., Advanced mass spectrometers for hydrogen isotope analyses, 9:50496 (R;US)
Chatterjee, A., Neutron evaporation following heavy ion reactions for systems with $150 < A < 190$, 9:50883 (RA;AU)
Chen, C.H., *See* Ferrell, W.R., 9:50754
See Hurst, G.S., 9:50706
Chen, J.Y., *See* McLean, W.J., 9:50538
Chen, M.M., *See* Kasza, K.E., 9:49710
Chen, P., Chiral-symmetry breaking in a composite model with scalars based on lattice gauge theory, 9:50809 (J;US)
Chen, Y., Diffusion of deuterium and hydrogen in rutile TiO_2 crystals at low temperatures, 9:50208 (J;US)
See Cahen, D., 9:49628
Chen, Y.R., *See* Hashimoto, A.G., 9:49583
Chen, Y.S., *See* Vaughn, J.M., 9:50566
Cheng, L.J., Enhanced diffusion of phosphorus at grain boundaries, 9:49637 (BA;US)
Cheng, Y.S., Use of a massive volume air sampler to collect fly ash for biological characterization, 9:50535 (J;US)
Cherdyntsev, V.V., Peculiarities of two-dimensional particle motion at axial channeling, 9:50949 (RA;SU;In Russian)
Chermant, J.L., Investigation of the growth kinetics of metal carbide systems, 9:50170 (TJ;US)
Chern, I.L., Front tracking for gas dynamics, 9:50398 (R;US)
Chernov, I.P., *See* Adeev, G.D., 9:50736
See Ovcharov, A.M., 9:51053
Chi, R.D.H., *See* Rao, V.U.S., 9:49582
Chiang, S.W., *See* Possin, G.E., 9:50227
Chiang, T.C., *See* Miller, T., 9:50151
Chick, L.A., Nuclear waste glass composition limitations, 9:49557 (R;US)
Chidley, B.E., Programme of research into the management and storage of radioactive waste. Radionuclide source term and migration. Annual report 1983, 9:49528 (R;GB)
Radionuclide source term and migration. Progress report April 1983 - September 1983, 9:49526 (R;GB)
Chillingworth, R.S., Alternative modes of processing SRC in an expanded-bed LC-finer to produce low-nitrogen distillates, 9:49372 (J;US)
Chisholm, A., *See* Garrett, R., 9:50831
Chisolm, A., *See* Ulbricht, J., 9:50832
Chiu, C.B., *See* Chen, P., 9:50809
Chiu, S.C., *See* Chan, V.S., 9:50983
Chiu, S.Y., *See* Hub, K., 9:50062
Cho, D.H., *See* Chan, S.H., 9:49852
Choi, M.K., *See* Verhoff, F.H., 9:49386
Chou, D.P., SKYSHINE-P: a point kernel computer program for calculating SKYSHINE exposure rates, 9:50929 (R;TW;CH)
Chou, H.P., *See* Strauss, M.G., 9:50488
Choudhary, K.M., *See* Rothberg, G.M., 9:50304
Chrien, R.E., NEANDC specialists meeting on yields and decay data of fission product nuclides, 9:50819 (R;US)
Christensen, D., Electrocyclone development program, 9:50437 (RA;US)
Electrostatic granular bed filter development program, 9:49391 (RA;US)
Christensen, D.K., Alkali removal from hot combustion gases by adsorption on submicron-size particles, 9:49393 (RA;US)
Christensen, R.M., Optimization of the die entrance shape for polymeric extrusion, 9:50178 (R;US)
Christophorou, L.G., *See* Siomos, K, 9:50334
Christos, G.A., Chiral symmetry and the U(1) problem, 9:50795 (RA;AU)
Chu, D., Utility interface issues for grid-connected photovoltaic systems, 9:49657 (BA;US)
Chu, T.K., *See* Motley, R., 9:50999
Chumanova, O.V., *See* Pokhil, G.P., 9:51054
Church, E.L., Survey of the finish characteristics of machined optical surfaces, 9:50365 (R;US)
Chvalova, J., Reliability analysis of selected systems of nuclear power unit, 9:49774 (RA;CS;In Czech)
Ciliano, R., *See* Wakefield, R.A., 9:49961
Ciliberti, D.F., Hot gas cleanup using porous ceramic cross flow filters, 9:49394 (RA;US)
See Lippert, T.E., 9:49389
Claesson, J., *See* Doughty, C., 9:49908
Clamens, H., *See* Depois, J., 9:49909
Clark, B.R., *See* Klein, J.A., 9:49404
Clark, C.W., Effects of magnetic and electric fields on highly excited atoms, 9:50753 (BA;US)
Clark, G.J., Segregation and crystallization phenomena in germanium, 9:50153 (BA;NL)
Clark, J., *See* De Vaul, D., 9:49921
Clark, N.A., *See* Safinya, C.R., 9:50320
Clark, R.G., *See* Byers, K.R., 9:49571
Clark, R.J., *See* Gujral, P.S., 9:49689
Clark, W.H.M., *See* Hugill, J., 9:51015
Clarke, J., *See* Devoret, M.H., 9:50372
See Hilbert, C., 9:50373, 9:50383
Claus, G., Microbial degradation of high nitrogen contents (primarily nitrate) in industrial waste water, 9:50598 (R;DE;In German)
Claytor, T.N., State-of-the-art review of acoustic techniques for application to the nondestructive evaluation of refractory concrete for coal gasification, 9:49329 (R;US)
Cleary, J., *See* Thomas, B.J., 9:50280
Cleaver, J.E., *See* Morgan, W.F., 9:50646
Clement, P., Glacial-hydrological conditions in Nordbosoe basin, Johan Dahl Land, 9:49596 (R;DK;In Danish)
Clemente, G.F., *See* Cave-Bondi, G., 9:50611
Cleveland, B.T., *See* Hurst, G.S., 9:50706
Clifford, M.J., Considering high occupancy vehicle alternatives in the urban transportation planning process: energy savings. Final report, August 1981-October 1983, 9:50029 (R;US)
Cline, H.E., Submicron conductor array fabricated from a recrystallized eutectic thin film, 9:50155 (BA;NL)
See Liu, Y.S., 9:50234
Cline, T.L., *See* Pizzichini, G., 9:50713
Cluett, C., Nuclear waste repository in basalt: preliminary socioeconomic assessment, 9:49558 (R;US)
Cluff, C.L., *See* Jensen, R.J., 9:50309
Coates, C.W., Method for preparing surfaces of metal composites having a brittle phase for plating, 9:50148 (P;US)
Coester, F., *See* Polyzou, W.N., 9:50792
Coghlan, W.A., Critical radius and critical number of gas atoms for cavities containing a Van der Waals gas, 9:51018 (R;US)
Cogswell, F.D., *See* Luton, J.N., 9:51029
Cohen, B.I., *See* Brengle, T.A., 9:51013
Cohen, D.D., Ion induced x-ray emission, 9:50732 (RA;AU)
New look at the L subshell Coulomb deflection factors for inner shell ionisation, 9:50733 (RA;AU)
See Harrigan, M.F., 9:50734
Cohen, J.J., Optimization of public and occupational radiation protection at nuclear power plants. Executive summary, 9:49891 (R;US)
Cole, S.L., Solar collection, 9:49696 (R;US)
Collins, H.D., *See* Busse, L.J., 9:49814

Colombo, L., Movement of edge dislocations in KCl by large electric fields, 9:50254 (J;GB)
Comer, K., *See* Miller, D.P., 9:49937
Compere, A.L., *See* Griffith, W.L., 9:50316
Compton, R.N., Multiphoton ionization of atomic cesium, 9:50721 (R;US)
See Dodhy, A., 9:50719
See Klots, C.E., 9:50726
See Miller, J.C., 9:50340, 9:50720
Congdon, J.V., *See* Breault, R.D., 9:49962
Conlon, J., Ground state energy of an interacting bose gas, 9:50974 (R;AT)
Conn, R.E., Comparison of low-rank coal ash sintering characteristics with pilot plant ash fouling tendencies, 9:49377 (R;US)
Consiglio, R., *See* Camara, A.S., 9:49510
Cooper, C.D., *See* Compton, R.N., 9:50721
Cooper, M., *See* Zaremski, D.R. Jr., 9:49624
Cooper, M.D., *See* Bowman, J.D., 9:50878
Cooper, S.L., Microstructural analysis of ion containing polymers. Final report, July 1, 1981-June 30, 1984, 9:50175 (R;US)
Coote, G., Studies of obsidian and glass via the nuclear microprobe and sodium depth profiles, 9:50286 (RA;AU)
Corbett, B.L., Bulk Shielding Facility. Quarterly report, January-March 1984, 9:49838 (R;US)
Corbit, C.D., *See* Gillings, J.C., 9:49897
Corderman, R.R., *See* Delahoy, A.E., 9:49646
Cordey, J.G., Review of current drive by fast ion injection, 9:50982 (RA;GB)
Cornec, A., Treatment of material laws for approximate J-estimation methods, 9:50111 (R;DE)
Cornelius, W.D., CW operation of the FMIT RFQ accelerator, 9:50448 (R;US)
Corneliussen, C, Risk for collisions with oil and gas installations on the Norwegian continental shelf. Collection and preparation of data. Part report No. 3. Reported infringements of safety zones around Norwegian offshore installations, 9:49453 (R;NO)
Cornish, D.N., *See* Hoard, R.W., 9:51042
Corradini, M.L., *See* Badger, B., 9:51033
Correra, L., *See* Bentini, G.G., 9:50249
Corum, K.R., Stimulating energy conservation in commercial buildings: A simulation analysis of alternative policies, 9:50027 (J;GB)
Costa, J.E.R., Timing analysis of hard X-ray emission and 22 GHz flux and polarization in a solar burst, 9:50688 (R;BR)
Costantino, M., Experimental high pressure equation of state of a very fast burning gun propellant, 9:50506 (R;US)
Coster, M., *See* Chermant, J.L., 9:50170
Coughtrey, P.J., Development of biosphere codes for use in assessment of the radiological impact of geological repositories for radioactive waste, 9:49536 (R;GB)
Coulter, D.R., Chemical bonding technology for terrestrial photovoltaic modules, 9:49619 (R;US)
See Liang, R.H., 9:49631
Coultis, D., Guide to personal deaktop computing at ANL, 9:51049 (R;US)
Count, B.M., Hydrodynamic studies on floating attenuator wave energy devices, 9:49732 (R;GB)
Coutant, C.C., Striped bass, temperature, and eutrophication: a speculative hypothesis for environmental risk, 9:50563 (R;US)
Coveney, E.A., *See* Novak, K.M., 9:50521
Cowan, D.O., *See* Beno, M.A., 9:50315
Cowley, P.J., *See* Carr, D.B., 9:51060
See Nicholson, W.L., 9:51059
Cowser, K.E., *See* Klein, J.A., 9:49404
Cox, C.D., *See* Dodd, C.V., 9:50408
Cox, M., ICRF enhancement of beam-driven currents, 9:50985 (RA;GB)
Coyne, P.I., Comparative ozone dose response of gas exchange in a ponderosa pine stand exposed to long-term fumigations, 9:50648 (J;US)
Crabb, D.G., Radiation damage in an ethylamine-borane:ammonia target, 9:50441 (R;US)
Craft, B.D., *See* Bowman, R.C. Jr., 9:50163
Craig, L.J., *See* Jory, H.R., 9:51035
Craig, R.W., Geohydrologic data for test well UE-25p No. 1, Yucca Mountain area, Nye County, Nevada, 9:49561 (R;US)
Crawford, H.J., *See* Olson, D.L., 9:50482
Creutz, C., *See* Mok, C.Y., 9:50336
Croci, R., *See* Canobbio, E., 9:50988, 9:50993
Cronauer, D.C., The importance of hydrogen donors in the solvent conversion of eastern shale, 9:49499 (BA;US)
Crossley, M.R., Minimum critical crack depths in pressure vessels guidelines for nondestructive testing, 9:49802 (R;GB)
Crotty, G.T., *See* Cheng, L.J., 9:49637
Crowe, K.M., *See* Breunlich, W.H., 9:50752
Crowley, C.I., A comparison of CW laser and electron-beam recrystallization of polysilicon in multilayer structures, 9:50225 (BA;NL)
Csehati, A., *See* Rivier, M., 9:50246
Csernai, L.P., *See* Barz, H.W., 9:50913
Cuddihy, E.F., *See* Coulter, D.R., 9:49619
See Garcia, A. III, 9:49640
Cullis, A.G., *See* Clark, G.J., 9:50153
Cunningham, M.E., GT2R2: an updated version of GAPCON-THERMAL-2, 9:49816 (R;US)
Curran, T.C., *See* Hunt, W.F. Jr., 9:50531
Currie, L.A., Lower limit of detection: definition and elaboration of a proposed position for radiological effluent and environmental measurements, 9:50540 (R;US)
Curtis, C.W., *See* Tarrer, A.R., 9:49355
Curtis, S.B., Hypoxic cell sensitizers and heavy charged particle beams may play complementary roles in killing hypoxic tumor cells, 9:50618 (J;US)
Curtiss, L.A., Theoretical study of the reaction of AlF^-_4 and $AlCl^-_4$ with oxide and sulfide ions, 9:50314 (J;US)
Cybulskis, P., *See* Wooton, R.O., 9:49894
Czuck, G., Crack growth under cyclic thermal shock loading, 9:49804 (RA;DE;In German)
See Stamm, H., 9:50130

D

D'Agostini, G., *See* Achterberg, O., 9:50766, 9:50774
Dabas, R.S., *See* Somayajulu, Y.V., 9:50717
Daeubler, H.G., *See* Schoenauer, W., 9:50403
Daeubler, M.A., Microstructure and mechanical properties of titanium alloys, 9:50137 (R;DE;In German)
Dagle, G.E., Plutonium-induced wounds in beagles, 9:50621 (J;GB)
See Ballou, J.E., 9:50620
Dahl, W., *See* Hesse, W., 9:50120
Daiello, R.V., *See* Catalano, A., 9:49651
Dale, J.M., *See* Rosseel, T.M., 9:50149
Dale, V.H., Comparison of tree growth models, 9:50548 (R;US)
Forest growth trends in the eastern United States: status report on empirical and modeling approaches, 9:50524 (R;US)
Dalverny, L.E., Calamity Hollow Mine Fire Project. 3. Instrumentation for combustion monitoring, process control, and data recording. Report of investigations/1984, 9:49415 (R;US)
Daly, E.L. Jr., *See* Gerrish, H.P., 9:49581
Damyanov, B., *See* Uzunov, I., 9:49826
Damyanov, Bl., *See* Khristov, Kh., 9:50979
Dana, C., *See* Dana, T., 9:49734
Dana, T., Energy on an independent farm. Final performance report, 9:49734 (R;US)
Danielson, M.J., Evaluation of the three-point method to measure corrosion rates, 9:49730 (J;US)
Danner, D.A., *See* Cronauer, D.C., 9:49499
Dao, C., *See* Liang, R.H., 9:49631
Dapkunas, S.J., *See* Natesan, K., 9:50152
Darlaston, B.J., Some aspects on leak before break; their quantification and application, 9:49806 (RA;DE)
Das, R., *See* Krauthamer, S., 9:49654
Das, U., *See* Bhattacharya, P.K., 9:50213
DasGupta, A., *See* Rosseel, T.M., 9:50149
Daud, T., *See* Cheng, L.J., 9:49637
David, S.A., Microstructure of rapidly quenched type 308 stainless steel weld filler metal and its implications on rapid solidification processes, 9:50104 (R;US)
See Inouye, H., 9:50107
Davidson, C.I., *See* Lindberg, S.E., 9:50522
Davie, R.F., *See* Byrne, A.P., 9:50901
Davies, G.R., Life-cycle cost analysis project. Final report, 9:50001 (R;US)
Davies, R.F., Yrast states and isomers in ^{205}At, 9:50899 (RA;AU)
Davis, J.F., *See* Spicer, L.D., 9:50292
Davis, J.R., Characteristics of recrystallised polysilicon on SiO_2 produced by dual electron beam processing, 9:50241 (BA;NL)
See Rohatgi, A., 9:49635
Davis, L.I. Jr., *See* Bakalyar, D.M., 9:50513
Davis, R. Jr., *See* Hurst, G.S., 9:50706
Davis, T.D., Electric utility sponsored conservation programs: case studies of implementation experience, 9:50042 (RA;US)
Davis, W.T., *See* Keener, T.C., 9:49403

Daw, M.S., Embedded-atom method: Derivation and application to impurities, surfaces, and other defects in metals, 9:50143 (J;US)
Dawson, J.M., *See* Decyk, V.K., 9:50992
Dawson, L.R., Growth and properties of semiconductor strained-layer superlattices, 9:50186 (R;US)
Day, D.E., Chemically durable nitrogen containing phosphate glasses useful for sealing to metals, 9:50211 (P;US)
Day, J.A., New downhole cable emplacement method developed for LLNL's Nuclear Test Program, 9:50512 (R;US)
Day, R.H., Application of layered synthetic microstructures to high-temperature plasma diagnostics, 9:50498 (R;US)
de Colon, I.A., Conserving energy in your home, 9:50008 (R;PR;In Spanish)
de Cuasmaecker, P., *See* Berends, F.A., 9:50772, 9:50773
De Jarlais, G., Hydrodynamic stability of inverted annular flow in an adiabatic simulation, 9:50407 (J;US)
De Jonghe, L.C., *See* Wu, S.J., 9:50162
de la Zerda, A., *See* O'Brien, K., 9:50709
De Marco, F., *See* Santini, F., 9:50998
De Vaul, D., Post-war energy economics: the urban and regional implications, 9:49921 (RA;US)
De Volpi, A., Water-level and fuel-failure external monitoring, 9:49850 (R;US)
Dean, J.W., *See* Boenig, H.J., 9:49903
DeArmond, M.K., *See* Segers, D.P., 9:50305
Deaton, T., *See* Hirschfeld, T., 9:50575, 9:50580
Deb, S.K., *See* Noufi, R., 9:49629
Debenham, A.A., Causes of larger degraded core frequencies in earlier safety studies compared with Sizewell 'B', 9:49900 (R;GB)
Debertin, K., Guide and instructions for determining γ-ray emission rates with germanium detector systems, 9:50487 (TG;AU)
Decicco, J., *See* Johnson, D.H., 9:49679
Decman, D.J., In-beam alpha, electron, and gamma-ray spectroscopy of ^{215}Fr, 9:50897 (R;DE)
Decyk, V.K., Velocity redistribution in lower hybrid current drive, 9:50992 (RA;GB)
Dederick, J.D., *See* Kelly, K.E., 9:49505
Dedolph, R.R., *See* Ter Haar, G.L., 9:50650
Deeds, W.E., *See* Dodd, C.V., 9:50408
DeHaven, R.A., *See* York, R.L., 9:50463
Delahoy, A.E., Disilane versus monosilane: a comparison of the properties of glow-discharge a-Si:H films and solar cells, 9:49646 (BA;US)
Delcheva, D., *See* Radicheva, M., 9:49830
See Shekherov, L., 9:50558, 9:50559
DeLeon, R.L., Molecular beam electric resonance study of the ground and excited states of cyano acetylene, 9:50318 (R;US)
Delhen, R., Optiflow. Description of a system for regional analysis of flow and utilization of forest raw materials, and one method of application, 9:49920 (R;SE;In Swedish)
DeMarche, T.E., *See* Breault, R.D., 9:49962
Demler, T., *See* Zimmermann, C., 9:50121
Dempsey, C.R., Removal of polynuclear aromatic hydrocarbons from primary aluminum air pollution control scrubber wastewater, 9:50572 (R;US)
Demus, H., Static and dynamic strength of gas turbine blade material under conditions of high temperature corrosion, 9:50136 (R;DE;In German)
denBoer, M.L., *See* Rothberg, G.M., 9:50304
Denisov, F.P., Theory of orientational acoustic effect at channeling, 9:50951 (RA;SU;In Russian)
Dennison, E.W., JPL tests of a LaJet concentrator facet, 9:49705 (R;US)
Depois, J., Study of storage capacity in a captive aquifer used as geothermal reservoir. Final report and summary report, 9:49909 (R;LU;In French)
Deringer, J., *See* Olsen, A.R., 9:50019, 9:50020, 9:50021, 9:50022
Derkacheva, L.D., Kinetics of the photoprotolytic reaction in a solution of coumarin dye, 9:50344 (TJ;DE;In German)
Dermenzhiev, E., *See* Uzunov, I., 9:49826
DeRosa, E., *See* Davis, T.D., 9:50042
Desai, M., *See* Jalan, V., 9:49338
Desai, U.D., *See* Pizzichini, G., 9:50713
Desch, M.D., A radiometric Bode's Law: Predictions for Uranus, 9:50701 (R;US)
Deschanvres, A., *See* Chermant, J.L., 9:50170
Desportes, H., *See* Marston, P.G., 9:51041
Detilleux, E., Processing of highly radioactive nuclear waste, 9:49563 (TJ;GB)
Deuter, A., *See* Berger, C., 9:50767
Deutsch, E., *See* Bandoli, G., 9:50354
Devoret, M.H., Resonant activation of a Josephson junction, 9:50372 (R;US)
Dews, T.W., *See* Brosey, W.D., 9:50418
Di Marzio, F., Analytic distorted wave approximation for intermediate energy pion and proton inelastic scattering, 9:50836 (RA;AU)
Diamond, R.M., *See* Schueck, C., 9:50896
Dickerman, J.C., *See* Glover, R.L., 9:50438
Dickson, E.M., Wind power parks: 1983 survey, 9:49735 (R;US)
Diehl, J.W., *See* Olson, E.S., 9:49379
Dienst, W., Chemical interactions between UO_2 and zircaloy-4 from 1000 to 2000°C, 9:49867 (RA;DE;In German)
Dietderich, D.R., *See* Wu, I.W., 9:50141
Dietrich, D., *See* Wong, S., 9:50394
Dietrich, L., State and development of ion sources for accelerators, 9:50466 (R;DD;In German)
Dietrichs, H.J., Increase of efficiency in cooled high temperature turbines. Phase I, 9:50069 (R;DE;In German)
Dietz, P.W., *See* Snaddon, R.W.L., 9:50439
Dimchev, T., Detectable limits of low-level concentration of the radionuclides, 9:50479 (RA;BG;In Bulgarian)
Dimon, P., *See* Wong, P.Z., 9:50942
Dimov, K., *See* Uzunov, I., 9:49826
Ditmars, J.D., *See* Baker, R.M., 9:50567
Dittrich, H.G., *See* Arendt, F., 9:51034
Dixon, E., *See* Travis, C.C., 9:50636
Dobrev, V., Multiplet classification of the reducible elementary representations of real semisimple Lie groups, 9:50793 (RA;BG;In Bulgarian)
Doctor, S.R., *See* Busse, L.J., 9:49814
Dodd, C.V., Experimental verification of eddy-current flaw theory, 9:50408 (R;US)
Dodd, L.R., Rho decay in the cloudy bag model, 9:50808 (RA;AU)
Dodds, H.L. Jr., SKINATH - a computer program for solving the reactor point kinetics equations with simple thermal-hydraulic feedback, 9:49801 (R;US)
Dodhy, A., Multiphoton ionization of cesium atoms above and below the two-photon ionization threshold, 9:50719 (R;US)
Dodrill, B., *See* Kochman, M.P., 9:49947
Doggett, J.N., *See* Nelson, W.D., 9:51020
Doherty, T.J., *See* Allen, R.D., 9:49904
Dolfini, S.M., *See* Williams, M.W., 9:50183
Dolgos, J.G., *See* Scott, L.W., 9:50364
Dollimore, J., Supercritical solvent extraction, 9:49334 (RA;US)
Donev, S., Theory of gravitational field, 9:50959 (RA;BG;In Bulgarian)
Donhoffer, D., On-stream determination of Zn-content in Zn-ore slurries by radioisotope excited X-ray fluorescence, 9:50291 (R;AT)
Dooley, J.E., Putting risk analysis into perspective: a comparative review of major societal risk studies of nuclear power, 9:49935 (R;SE)
Doplicher, S., Current algebra and the local nature of symmetries in local quantum theory, 9:50803 (R;DE)
Dore, H., *See* Wakefield, R.A., 9:49961
Dostal, K.A., *See* Dempsey, C.R., 9:50572
Doughty, C., Steady flow model user's guide, 9:49908 (R;US)
Downhower, F.H., Protective circuit for thyristor controlled systems and thyristor converter embodying such protective circuit, 9:50424 (P;US)
Doyle, T.E., Raman and luminescence spectroscopy of zirconium oxide with the use of the MOLE microprobe, 9:49854 (R;US)
Doyle, T.W., *See* Dale, V.H., 9:50548
Dracoulis, G.D., Long lifetimes and moments through the backbend in ^{160}W, 9:50886 (RA;AU)
Quadrupole moments of the 12^+ isomers in mercury 188 and mercury 190, 9:50888 (RA;AU)
See Byrne, A.P., 9:50900, 9:50901
See Davies, R.F., 9:50899
Draggan, S., Microcosm as a tool for estimation of environmental transport of toxic materials, 9:50555 (J;GB)
Drechsel, Possibilities to improve the efficiency of power transmission, 9:50086 (RA;DD;In German)
Drenska, S., *See* Mavrodiev, S., 9:50780
Dresner, J., *See* Catalano, A., 9:49651
Dresner, L., *See* Luton, J.N., 9:51029
Drost, W., *See* Moser, H., 9:50656
Drowley, C.I., *See* Zorabedian, P., 9:50224
Drumm, P.V., Interaction of ^{7}Li with ^{16}O at 50 MeV, 9:50839 (RA;AU)
See Fifield, L.K., 9:50851
See Hotchkiss, M.A.C., 9:50860
See Kondo, Y., 9:50852
Dubinin, E.M., *See* Pissarenko, N.F., 9:50683

Duchacek, V., Problems of chromium determination in biological materials, 9:50269 (RA;CS;In Czech)
Dudt, P.J., *See* Kleinpeter, J.A., 9:49375
Duerden, P., Archaeometry, 9:50285 (RA;AU)
Dufour, J.P., *See* Olson, D.L., 9:50482
Duftschmid, K.E., Austrian primary standard for ionizing radiation dosimetry. Results of international intercomparisons, 9:50940 (R;AT)
Radiation protection problems by nonionizing electromagnetic radiation in Austria, 9:50653 (R;AT)
Duhamel, A.P., *See* Klein, J.A., 9:49404
Dukart, R., *See* Wong, S., 9:50394
Duke, L.D., Energy management assistance for small and medium-size manufacturers. An evaluation of the EADC program, 9:49979 (R;US)
Duncan, L.B., Empirical testing of structural deflection modeling of large photovoltaic modules, 9:49649 (BA;US)
Duncan, M., *See* Jain, R., 9:49392
See Yung, S.C., 9:49402
Durham, M., *See* Rinard, G., 9:49755
Durham, W.B., *See* Patrick, W.C., 9:49560
Dutcher, J.S., *See* Bechtold, W.E., 9:50640
Dutta, S., Laser assisted deposition, 9:49618 (R;US)
Laser-assisted solar cell metallization processing. Quarterly report, March 13-June 12, 1984, 9:49609 (R;US)
Duynisveld, W.H.M., Development of numerical simulation models for vertical solute transport in unsaturated soils and unconsolidated sediments, 9:50554 (R;DE;In German)
Dwight, C.C., Incineration of hazardous and low-level radioactive waste by a small generator. Final report, 9:49564 (R;US)
Dworak, W., *See* Frevert, E., 9:49573
Dworkin, A.S., *See* Buchanan, A.D., 9:50326
See Zingg, S.P., 9:50327
Dyakov, V.Ye., *See* Grekov, D.L., 9:50995
Dziwisch, G.F., Possibilities of electronics and microelectronics for optimation of the fuel consumption of cars, 9:50074 (RA;DD;In German)

E

Eager, G.S. Jr., *See* Sosnowski, M., 9:49759
Edkins, J.E., *See* Hess, J.W., 9:50573
Edmonds, P.H., Design and fabrication of a beryllium limiter for ISX-B, 9:51027 (R;US)
Edner, G., *See* Alden, M., 9:50077
Edwards, M.S., *See* Salmon, R., 9:49373
Efthimion, P., *See* Motley, R., 9:50999
Efurd, D.W., *See* Perrin, R.E., 9:50290
Egan, P., *See* Wong, S., 9:50394
Ehrfeld, W., *See* Becker, E.W., 9:49511
Eichner, F.N., *See* Ballou, J.E., 9:50620
Ellingsfeld, H., *See* Iden, R., 9:49703
Eissen, W., Drying grapes with solar energy, 9:49682 (R;DE;In German)
Ekdahl, C.A., Capacitively-coupled inductive sensor, 9:50429 (P;US)
Eklund, L.G., *See* Wakefield, R.A., 9:49961
El-Bassioni, A.A., *See* Rhyne, W.R., 9:49440
El-Guebaly, L., *See* Badger, B., 9:51033
Eliezer, D., *See* Raizman, A., 9:50113
Elliman, R.G., *See* Rossiter, K.G., 9:50192
Ellingson, W.A., *See* Claytor, T.N., 9:49329
Elliott, A.H., Biomass wood. Final technical report, 9:49981 (R;US)
Elliott, D.C., *See* Sealock, L.J. Jr., 9:49357
Elliott, G.R.B., Apparatus for recovering gaseous hydrocarbons from hydrocarbon-containing solid hydrates, 9:49483 (P;US)
Ellis-Akovali, Y., *See* Schueck, C., 9:50896
Ellman, R.C., Hydrogen production from low-rank coals, 9:49332 (RA;US)
Elsener, K., *See* Ulbricht, J., 9:50832
Emanuel, W.R., Some aspects of understanding changes in the global carbon cycle, 9:50523 (R;US)
Embacher, F., Static spin-3/2 perturbations of two-black hole system, 9:50705 (R;AT)
Emmert, G.A., *See* Badger, B., 9:51033
Englade, R.C., Computational model for lower hybrid current drive, 9:50991 (RA;GB)
Engler, J., *See* Achterberg, O., 9:50766, 9:50774
Enome, S., *See* Kane, S.R., 9:50687
Epicier, T., Precipitation of the W_2C semicarbide of tungsten in tungsten sheets, 9:50169 (TJ;US)
Erb, J., *See* Arendt, F., 9:51034
Eremin, N.V., Influence of orientation of compound nuclei displacement in diametrical plane on axial shadow shape, 9:50855 (RA;SU;In Russian)
Use of total shadow profiles for obtaining the information on compounds nuclei lifetime, 9:50854 (RA;SU;In Russian)
Erlbaum, N.S., Incorporating energy analysis in the transportation improvement program process, 9:50031 (R;US)
Esat, M.T., *See* Vermeer, W.J., 9:50841
Escher-Vetter, H., *See* Moser, H., 9:50656
Esnouf, C., *See* Epicier, T., 9:50169
Essig, T.H., *See* Gillings, J.C., 9:49897
Essling, M.A., *See* Toohey, R.E., 9:50556
Esteve, D., *See* Devoret, M.H., 9:50372
Esvelt, T., *See* Wright, S., 9:50046
Etnier, E.L., *See* Travis, C.C., 9:50636
Ettensohn, F.E., A tectonic-climatic approach to the deposition of the Devonian-Mississippian black-shale sequence of North America, 9:49493 (BA;US)
Evans, W.D., *See* Pizzichini, G., 9:50713
Everett, L.G., Vadose zone monitoring for hazardous waste sites, 9:50553 (R;US)
Evtimova, E., *See* Karabsky, B., 9:50962
Ewart, F.T., *See* Chidley, B.E., 9:49526, 9:49528
Ewins, P.J., *See* Richardson, M.G., 9:49463

F

Faanes, T., *See* Mathiesen, M., 9:50581
Fabrikant, J.I., *See* Woodruff, K.H., 9:50626
Facci, M., Photoneutron cross section for ^{12}C, ^{14}N and ^{16}O, 9:50840 (RA;AU)
Faevelen, M, Ekofisk E-data. Data report: Jan-Jun 1982, 9:50515 (R;NO)
Statfjord E-data. Data report: Jan-Dec 1982, 9:50516 (R;NO)
Statfjord E-data. Data report: Jan-Dec 1981, 9:50517 (R;NO)
Fahlander, C., *See* Davies, R.F., 9:50899
Fahrenbruch, A.L., *See* Werthen, J.G., 9:49647
Fahy, L.J., *See* Lasaki, G.O., 9:49500
Faidas, H., *See* Siomos, K, 9:50334
Fakirov, D., Mass and form factor effects in spectrum and width of the semileptonic decays of charmed mesons, 9:50779 (RA;BG;In Bulgarian)
Falcone, S., Ash and slag characterization, 9:49431 (RA;US)
Falkensteiner, F., Proton decay in the framework of a non-relativistic potential model, 9:50786 (R;AT)
Fan, J.C.C., *See* Tsaur, B.Y., 9:50231
Fan, L.S., *See* Fee, D.C., 9:49434
Fan, L.T., *See* Song, J.C., 9:50435
Fang, J.M., *See* Imhoff, K.L., 9:49952
Fanger, H.U., *See* Schnier, C., 9:50569
Fano, U., Basic studies of atomic dynamics. Progress report, September 1, 1983-July 31, 1984, 9:50727 (R;US)
Faoro, R.B., *See* Hunt, W.F. Jr., 9:50531
Fardy, J.J., Current techniques in neutron activation analysis, 9:50278 (RA;AU)
Use of computers in neutron activation analysis, 9:50273 (RA;AU)
Farget, M.A., Evaluation of energy from the biomass of agricultural origin: a review of the achievements in France and Italy. Series fast No. 15, 9:49591 (R;LU;In French)
See Ahner, D., 9:49611
Farlow, G.C., *See* White, C.W., 9:50157
Farnum, S.A., *See* Dollimore, J., 9:49334
See Rindt, J.R., 9:49333
Fasano, D.M., Rate determination for F + CH_4 by real-time competitive kinetics, 9:50342 (J;NL)
Fasching, G.E., Air-flow regulation system for a coal gasifier, 9:49365 (P;US)
Fastow, R., *See* Gyuali, J., 9:50233
Fathy, D., *See* Appleton, B.R., 9:50099
See Holland, O.W., 9:50184
Faubel, W., Decontamination of carbonate containing process streams in a reprocessing plant by chromatography, 9:49519 (R;DE;In German)
Fauchet, P.M., Picosecond laser-induced surface transformations in solids, 9:50253 (BA;NL)
Faughnan, B., *See* Catalano, A., 9:49651
Fechtig, H., *See* Foote, J.H., 9:50680
Federmann, E., *See* Zaremski, D.R. Jr., 9:49624
Fee, D.C., Analytical model for freeboard and in-bed limestone sulfation in fluidized-bed coal combustors, 9:49434 (J;GB)
Feiner, M.S., *See* Sanderson, C.G., 9:50539
Felch, K.L., *See* Jory, H.R., 9:51035
Feldman, S., Determinants of interest in new energy reduction projects among commercial and industrial ratepayers, 9:49993 (RA;US)

Fels, M.F., Can a simple physically-based model provide accurate scorekeeping of electricity savings in houses?, 9:49991 (RA;US)
Fenimore, E.E., *See* Pizzichini, G., 9:50713
Fennell, L.E., *See* Biegelsen, D.K., 9:50226
Ferland, G.J., Cosmic rays and the emission line regions of active galactic nuclei, 9:50694 (R;US)
Ferrari, A., *See* Bertolotti, M., 9:50251
Ferrell, W.R., Time-resolved fluorescence spectra of rotationally cooled NO2, 9:50754 (J;GB)
Ferry, R., *See* Theilacker, J., 9:50471
Fewell, M.P., Relativistic corrections to the theory of Coulomb excitation, 9:50908 (RA;AU)
See Vermeer, W.J., 9:50841
Fiege, A., *See* Bork, G., 9:49878
See Rininsland, H., 9:49864
Fields, D.E., Exposure and risk calculations for disposal of wastes having minimal radioactivity, 9:49566 (R;US)
Fietz, J., *See* Sahre, P., 9:50543
Fifield, L.K., Masses and level schemes of very neutron-rich nuclei with A approximately 30, 9:50851 (RA;AU)
See Drumm, P.V., 9:50839
See Hotchkiss, M.A.C., 9:50860
Filby, R.H., Organic and inorganic mercury species in the Ft. Lewis solvent refined coal pilot plant water treatment process. Technical report, 9:49361 (R;US)
Filippone, W.L., Simulating electron energy loss fluctuations in deterministic streaming ray calculations, 9:50933 (J;US)
Filippov, G.M., Decay of a packet incident on monocrystal and evolution of a two-particle system and its motion in medium, 9:50950 (RA;SU;In Russian)
Filter, W.F., *See* Chang, J., 9:50501
Fink, J., Evaporation of R11/R113 mixtures at a horizontal cylinder in crossflow, 9:50402 (R;DE;In German)
Fink, R.W., Nuclear chemistry research and spectroscopy with radioactive sources. Twentieth annual progress report, September 1, 1983-August 31, 1984, 9:50869 (R;US)
Finlayson, P.T., *See* Downhower, F.H., 9:50424
Finn, J.E., *See* Hirsch, A.S., 9:50868
Finn, J.M., *See* Grossmann, J.M., 9:50451
Finnemore, D.K., *See* Sue, J.J., 9:50386
Firester, A., *See* Catalano, A., 9:49651
Fischer, C.F., Extension of the multiconfiguration Hartree-Fock program for continuum functions, 9:50729 (R;US)
Fischer, H.C., Comparison of energy storage systems in the United States chilled water versus two types of ice storage systems, 9:49969 (R;US)
Fischer, J., High position resolution and accuracy in ^{3}He two-dimensional thermal neutron PSDs, 9:50489 (BA;GB)
Fish, D.L., *See* Trivich, D., 9:49643
Fisher, P.W., *See* Tanase, M., 9:50310
Fishman, G.J., *See* Rich, F.J., 9:50715
Fisk, Z., *See* Smith, J.L., 9:50132
Fluegge, G., *See* Achterberg, O., 9:50766, 9:50774
Fluekiger, R., Advanced superconducting materials, 9:50129 (R;DE)
See Arendt, F., 9:51034
Foehl, J., *See* Jansky, J., 9:49805
Fogarassy, E., Impurity distribution profiles and surface disorder after laser induced diffusion, 9:50222 (BA;NL)
Folger, H., *See* Sellin, I.A., 9:50725
Foltyn, S.R., Alumina/silica multilayer coatings for excimer lasers, 9:50395 (R;US)
Fomin, S.P., *See* Shul'ga, N.F., 9:50953
Foote, G.S., *See* Chatterjee, A., 9:50883
Foote, J.H., Chemical and isotopic measurements of micrometeoroids by secondary ion mass spectrometry (A0187-2), 9:50680 (R;US)
Forch, K., Significance of the state of segregation of the carbide phase on the toughness properties of 20 MnMoNi 5 5 forgings, 9:50119 (RA;DE;In German)
Ford, A., New look at small power plants: an update on the environmental issues of interest to Italy, 9:49757 (R;US)
Ford, P.C., Studies relevant to the catalytic activation of carbon monoxide: the water gas shift reaction and related processes. Technical progress report, December 1, 1983-November 30, 1984, 9:49330 (R;US)
Ford, W.T., *See* Reichert, J.D., 9:49713
Forman, S.E., Review of PV module performance at DOE/MIT Lincoln Laboratory test sites during the period 1977-1982, 9:49648 (BA;US)
Forstbauer, B., *See* Achterberg, O., 9:50766, 9:50774
Forster, J.S., Fission lifetimes from blocking measurements: ^{19}F bombardment of a thin tantalum crystal, 9:50892 (RA;SU)
Fortner, R., *See* Wong, S., 9:50394
Fourney, W.L., *See* Young, C., 9:49495
Fowkes, W.R., Multimode harmonic power measurement of 40 MW pulsed S-band klystrons, 9:50464 (R;US)
Fox, L.J., *See* Jory, H.R., 9:51035
Fox, M.A., Chemically-modified electrodes in photoelectrochemical cells, 9:50330 (J;CA)
Fradkin, E.S., New results in quantum supergravity, 9:50966 (R;HU)
One-loop infinities in dimensionally reduced supergravities, 9:50965 (R;HU)
Francis, C.E., Hybrid system for producing and storing ice, 9:49683 (R;US)
Francis, C.W., *See* Boegly, W.J. Jr., 9:49399
See Watson, J.S., 9:49384
Franek, F., *See* Frevert, E., 9:49573
Frank, A.L., Characteristics of a radon diffusion chamber with electrical collection using plastic nuclear track detectors. Open file report 31 August 1982-30 November 1983, 9:50485 (R;US)
Frank, N.H., *See* Hunt, W.F. Jr., 9:50531
Frankel, D.S., *See* Stinespring, C.D., 9:49432
Franz, J.A., Arrhenius parameters for rearrangement of the neophyl, 1-indanylmethyl, 2-allylbenzyl, and 2-(2-vinylphenyl)ethyl radicals relative to hydrogen abstraction from tributylstannane, 9:50324 (J;US)
Frazier, M.E., *See* Pelroy, R.A., 9:50637
Freche, F., New knowledge in carburetor construction, 9:50072 (RA;DD;In German)
Freeman, A.J., *See* Ohnishi, S., 9:50142
Freiser, B.S., *See* Jacobson, D.B., 9:50322, 9:50323
See Russell, D.H., 9:50338
Frevert, E., Method for non contacting gauging of the wall thickness of tubes by backscattering of radiation, 9:50483 (R;AT;In German)
Wear measurements of cutting tools made of hard metal, 9:49573 (R;AT;In German)
Fridman, A., Introduction to ν quarkonium physics, 9:50776 (R;DE)
Friecsz, T.L., Predictive intercity freight network models: The state-of-the-art, 9:50033 (J;GB)
Fried, J.F., *See* Schubert, J., 9:50633
Friedman, A.M., *See* Rosenow, M.K., 9:50597
Friedman, N.W., *See* Stewart, W.L., 9:49926
Fries, D.C., *See* Achterberg, O., 9:50766, 9:50774
Fries, S., Test field Pellworm for wind turbines, 9:49736 (R;DE;In German)
Friesinger, G.M., *See* Luton, J.N., 9:51029
Friley, J.R., *See* Bampton, M.C.C., 9:49898
Frischknecht, F.C., Geophysical methods for locating abandoned wells, 9:50664 (R;US)
Frischkorn, H.J., *See* Sellin, I.A., 9:50725
Fry, R.J.M., Approaches to radiation guidelines for space travel, 9:50607 (R;US)
Radiation research report, 9:50604 (R;US)
Report on NCI symposium: comparison of mechanisms of carcinogenesis by radiation and chemical agents. II. Cellular and animal models, 9:50606 (R;US)
Fu, K.C., Thermal stress analysis for a wood composite blade, 9:49737 (R;US)
Fues, W., *See* Achterberg, O., 9:50766, 9:50774
Fujita, T., *See* Selcuk, M.K., 9:49664
Fukui, L.M., Summary of petrographic and chemical data for Palo Duro Basin samples examined by Bendix Field Engineering Corporation, Grand Junction, Colorado, as of April 29, 1983, 9:49538 (R;US)
Furiga, R.D., Statement of Deputy Assistant Secretary for the Strategic Petroleum Reserve before the Subcommittee on Oversight and Investigations of the Committee on Energy and Commerce, US House of Representatives, 9:49473 (R;US)
Furrer, J., *See* Nagel, K., 9:49520
Fuschini, E., Thermal vibration effects in diffusion model calculations of blocking dips, 9:50125 (RA;SU)

G

Gabbard, F., *See* Hurst, G.S., 9:50706
Gabor, J.D., Design features to enhance debris bed coolability, 9:49851 (R;US)
Gabriel, T.A., *See* Alsmiller, F.S., 9:50484
Gac, F.D., *See* Hurley, G.F., 9:50174
Gadzhokov, V., *See* Khristov, V., 9:50930
Gagliardi, C.A., *See* Moltz, D.M., 9:50867
Gajst, F., Investigation of semiconductor materials proton damage by radiography, 9:50198 (RA;SU;In Russian)
Gal, J., *See* Pinto, H., 9:50114
Gallo, M., *See* Coultis, D., 9:51049
Galvin, J.E., *See* Brown, I.G., 9:50743
Galya, L.G., *See* Cronauer, D.C., 9:49499
Gambill, W.R., National need for utilizing nuclear energy for process heat generation, 9:49795 (R;US)
Gamerdinger, K., *See* Achterberg, O., 9:50766, 9:50774
Gannon, J., *See* Theilacker, J., 9:50470, 9:50471
Ganow, H.C., *See* Patrick, W.C., 9:49560
Garcia, A., *See* Bohm, A., 9:50771
Garcia, A. III, Empirical testing of an analytical model predicting electrical isolation of photovoltaic models, 9:49640 (BA;US)
See Duncan, L.B., 9:49649
Garcia, M., Measurement of proton autoneutralization potential, 9:51010 (R;US)
Gardner, D.G., Absolute dipole gamma-ray strength functions for ^{176}Lu, 9:50894 (R;US)
See Gardner, M.A., 9:50893
Gardner, M.A., Isomer ratio calculations using modeled discrete levels, 9:50893 (R;US)
See Gardner, D.G., 9:50894
Garg, S.C., *See* Somayajulu, Y.V., 9:50717
Garibaldi, J.L., *See* Hansen, L.F., 9:50465
Garrett, R., Comparison of neutron-deuteron and proton-deuteron analysing powers, 9:50831 (RA;AU)
Garth, J.C., The generation and use of semi-empirical electron transport models, 9:50455 (J;US)
Garwin, E.L., Surface studies of Nb, its compounds, and coatings, 9:50140 (R;US)
Gassen, H.J., *See* Bellinghausen, B., 9:50828
Gastmans, R., *See* Berends, F.A., 9:50772, 9:50773
Gavaler, J.R., *See* Braginski, A.I., 9:50360
Gavin, B.F., *See* Brown, I.G., 9:50743
Geard, C.R., Paraquat and radiation effects on mouse C_3H 10T1/2 cells, 9:50617 (J;US)
See Hei, T.K., 9:50616
Gebureck, P., *See* Grondey, G., 9:49769
Geis, M.W., *See* Tsaur, B.Y., 9:50231
Geiss, M., Assessment of integrity for the pressure vessel internals of PWRs under blowdown loadings, 9:49879 (RA;DE;In German)
Geissler, I., Phase equilibria in aluminium-lithium-magnesium alloys at 200°C, 300°C and 400°C and their hardening in a casting state, 9:50134 (R;DE;In German)
Gelb, A., *See* Ham, D., 9:49339
Gelev, M., Determination of the natural gamma background by means of TLD. Some results of the environmental monitoring around the IRT-2000 reactor in Sofia, 9:49831 (RA;BG;In Bulgarian)
See Radicheva, M., 9:49829
Gell, Y., Stochastic generation of currents by lower-hybrid waves, 9:50994 (RA;GB)
Gellings, C.W., Conservation as a utility planning option, 9:50037 (RA;US)
Gellrich, N., Process-included topological changes of monocrystalline silicon plates, 9:50205 (R;DE;In German)
Gelting, R.L., *See* Breault, R.D., 9:49962
Genens, L., Design of the near shore seawater systems for an OTEC expanded test facility, 9:49681 (BA;US)
Gentillon, C.D., *See* Henry, E.B., 9:49765
Genung, R.K., *See* Gove, N.B., 9:49405
Genzel, H., *See* Berger, C., 9:50767
Georgason, M.A., *See* Geard, C.R., 9:50617
Gerdzhikov, V., Gauge equivalent difference evolution equations, 9:50980 (RA;BG;In Bulgarian)
Germain, P.J., Charged dangling bonds and crystallization in group IV semiconductors, 9:50245 (BA;NL)
Gerrish, H.P., Size distribution of airborne particulate matter emitted by the front-end processing of municipal solid waste feed material for large-scale anaerobic digesters, 9:49581 (J;US)
Gerwin, H.J., Sandia concentrator array testing experiences, 9:49717 (BA;US)
Ghauri, G.A., *See* Hussain, S.D., 9:50668
Giacani, G., *See* Tassoni, E., 9:49550
Giannetto, E., Quark hadron phase transition in bianchi type I cosmologies, 9:50672 (R;IT)
Gibbons, J., *See* Stultz, T., 9:50236
Gibson, E.D., *See* Sue, J.J., 9:50386
Gibson, W.M., *See* Forster, J.S., 9:50892
Giguere, P., *See* Steinke, R., 9:49886
Gijbels, R., Application of analytical methods for trace elements in geothermal waters. Part 2: Plombieres, Bains-les-Bains, Bourbonne (Vosges). Final report, 9:49724 (R;LU)
Gilbert, R.O., Comparing computing formulas for estimating concentration ratios, 9:50561 (R;US)
Giles, W., *See* Christensen, D., 9:50437
Gill, P.E., User's guide for QPSOL (Version 3.2): a Fortran package for quadratic programming, 9:51062 (R;US)
Gillette, G., Correlations of solar irradiance and daylight illuminance for building energy analysis, 9:50006 (R;US)
Gillette, J., *See* Hub, K., 9:50062
Gilliam, F.S., *See* Richter, D.D., 9:50545
Gillings, J.C., Characterization of emergency preparedness at DOE contractor facilities, 9:49897 (R;US)
Gillmore, D.W., *See* Strickland, L.D., 9:49337
Gilmer, G.H., Ising model simulations of impurity trapping in silicon, 9:50217 (BA;NL)
Gindele, K., Technical applications of solar energy. Project photovoltaic systems and project selective coatings. Final Report, Feb. 1982, 9:49620 (R;DE)
Ginevan, M., Computer code for general analysis of radon risks (GARR), 9:50615 (R;US)
Ginocchio, J.N., Medium energy probes and the IBM, 9:50915 (R;US)
Gipson, J.M., Path-integral derivation of the chiral anomalies of Dirac fermions coupled to gauge and gravitational fields in even space-time dimensions, 9:50813 (J;US)
Girard, J.G., *See* Olson, D.L., 9:50482
Girolimetti, G., *See* Tassoni, E., 9:49550
Girsberger, W., High temperature absorption heat pump, 9:49999 (R;CH;In German)
Giulianelli, G., *See* Tassoni, E., 9:49550
Givea, P.H., *See* Neill, P.H., 9:49352
Glaniz, C.S., *See* Ramsdell, J.V., 9:50542
Glaser, E., Investigation of laser and electron induced recrystallization of silicon layers by means of channeling techniques, 9:50200 (RA;SU)
Glazer, J., *See* Wu, I.W., 9:50141
Glimm, J., *See* Chern, I.L., 9:50398
Glotz, G., *See* Schoenauer, W., 9:50403
Glover, R.L., Results of the first two years of commercial operation of an organic-acid-enhanced FGD (flue gas desulfurization) system. Final report April 1982-April 1984, 9:50438 (R;US)
Gmeindl, F.D., Status and update of the DOE Molten Carbonate Fuel Cell Program, 9:49963 (RA;US)
Gnirss, G., *See* Bernecker, G., 9:50117
Godlewski, M.P., *See* Weizer, V.G., 9:49613
Goebbels, K., *See* Hoeller, P., 9:49807
Goeckeler, M., Kaehler's geometric description of Dirac fields, 9:50800 (R;DE)
Goeler, S. von, *See* Motley, R., 9:50999
Goetz, G., *See* Rivier, M., 9:50246
Goidich, S.J., *See* Ahluwalia, K.S., 9:49675
Goldman, C., Energy conservation in public housing: the San Francisco experience, 9:49996 (R;US)
Goldman, D.S., *See* Chick, L.A., 9:49557
Goldstein, M.J., *See* Murphy, F.H., 9:49457
Goldstick, R.J., Survey of flue gas condensation heat recovery systems. Final report February-October 1981, 9:50060 (R;US)
Goller, G.J., *See* Breault, R.D., 9:49962
Gombosi, T.I., *See* Hrehuss, G., 9:50673
Gonzalez, R., *See* Chen, Y., 9:50208
Goodman, M.M., *See* Knapp, F.F. Jr., 9:50589
Gorman, R.M., QCD and the spectroscopy of quarkonia, 9:50807 (RA;AU)
Gormley, R.J., *See* Rao, V.U.S., 9:49582
Gorshkov, O.N., *See* Vasil'ev, V.K., 9:50126
Gorshkov, V.G., Parity nonconservation effects in stereoisomers, 9:50735 (RA;SU;In Russian)
Gorski, A.J., *See* Francis, C.E., 9:49683
Gotsman, E., *See* Maor, U., 9:50777
Gottlieb, M., *See* Montgomery, W.D., 9:49479
Gould, M.D., Wigner coefficients for semi-simple lie groups: a pattern

calculus for O(n) and U(n), 9:50796 (RA;AU)
Gouldin, F.C., *See* McLean, W.J., 9:50538
Gourley, P.L., Quantum size effects in GaAs/GaAs/sub x/P_1/sub -x/ strained-layer superlattices, 9:50206 (J;US)
Gove, N.B., Fossil Energy Technology Environmental Program information system: making the data accessible, 9:49405 (R;US)
Grace, J.R., *See* Matsen, J.M., 9:49426
Grace, W.K., *See* Salzman, G.C., 9:50599
Graf, H.A., Optimization of flat and horizontally curved neutron monochromators for given diffractometer geometries, 9:50928 (R;DE)
Graf, J.M., Safety analysis and review system (SARS), 9:49932 (R;US)
Granek, H., Cosmological constraints on heavy neutrino lifetimes, 9:50782 (RA;AU)
Grawe, H., *See* Decman, D.J., 9:50897
Gray, W.H., Using PAFEC as a preprocessor for MSC/NASTRAN, 9:51023 (R;US)
See Luton, J.N., 9:51029
Grazhdankin, V.N., Analysis of multicomponent targets using H^+ and He^+ fast ion backscattering, 9:50741 (RA;SU;In Russian)
Use of target rotation method for separation of backscattered ion yields on different types of atoms of multicomponent target, 9:50740 (RA;SU;In Russian)
Green, A., *See* Bradbury, M.H., 9:49531
Green, M.A., Role of superconducting magnets in NMR medical imaging, 9:50596 (J;FR)
Green, M.C., Design of a tensor polarized deuterium target polarized by spin-exchange with optically pumped NA, 9:50459 (R;US)
Green, T.S., Progress report on negative ion beams based on User Development Workshop on negative ion based neutral beams, 15-16 February, 1983, Princeton, 9:51016 (RA;GB)
Greenbaum, E., Method for producing hydrogen and oxygen by use of algae, 9:49576 (P;US)
Greenberger, S., *See* Mintzer, O., 9:50002
Greene, D.L., Transportation energy use and efficiency in Tunisia, 9:50028 (R;US)
Transportation energy use and efficiency in Tunisia, 9:50032 (R;US)
Greengard, C.A., Three-dimensional vortex methods, 9:50756 (R;US)
Gregg, C.T., *See* Salzman, G.C., 9:50599
Gregory, R.B., *See* Wilson, S.R., 9:50237
Greiner, D.E., *See* Olson, D.L., 9:50482
Grekov, D.L., Plasma heating and current drive in a tokamak by the fast mode of low hybrid waves, 9:50995 (RA;GB)
Gresho, P.M., Consistent method for computing derived boundary quantities when the Galerkin FEM is used to solve thermal and/or fluids problems, 9:50758 (BA;GB)
Grette, R., *See* Frischknecht, F.C., 9:50664
Grienauer, W., *See* Schaudy, R., 9:50347, 9:50348
Griffin, A.B., *See* Hoffman, B., 9:49680
Griffin, F.J., *See* Hickey, J.R., 9:50681
Griffith, W.L., Solvent fermentations of pulp streams and their constituents, 9:50316 (R;US)
Griffiths, P.R., Novel analytical approaches to the study of coal beneficiation. Quarterly report, 9:49382 (R;US)
Grimsditch, M.H., *See* Nevitt, M.V., 9:50185
Grindley, T., Zinc ferrite hydrogen sulfide absorbent, 9:49340 (RA;US)
Grisaru, M.T., Bound state Regge trajectories in N=8 supergravity, 9:50814 (BA;US)
Groeger, A.W., *See* Kimmel, B.L., 9:50564
Groeneveld, K.O., *See* Sellin, I.A., 9:50725
Grondey, G., On-line acquisition and evaluation of core measuring data in light water reactors, 9:49769 (TJ;GB)
Gross, J.M., *See* Erlbaum, N.S., 9:50031
Gross, U., Heat transfer in a closed thermosyphon tube filled with near critical fluid, 9:50404 (R;DE;In German)
Grosse, H., Solitons in solid state physics, 9:50973 (R;AT)
Structure of the periodic system, 9:50750 (R;AT)
Grossmann, J.M., Flux diffusion and acceleration in a high current modified betatron. Memorandum report, 9:50451 (R;US)
Grotkamp, T., Installation of a three-dimensional simulation method for core-physical description of pebble bed reactors with multiple recycling process at the example of the AVR, 9:49800 (R;DE;In German)
Grozev, G., *See* Manushev, B., 9:50578
Grubbs, R.H., *See* Waymouth, R.M., 9:50307
Gruber, W., *See* Frevert, E., 9:49573
Gruebler, W., *See* Ulbricht, J., 9:50832
Gruenling, H.W., *See* Tolksdorf, E., 9:50118
Grutsch, P.A., *See* Segers, D.P., 9:50305
Gubbens, P.C.M., ^{57}Fe Moessbauer effect in $ThFe_3$ hydride, 9:50751 (J;US)
Guerrant, G.C., *See* Valentine, K.H., 9:50490
Guillory, J.L., High-temperature moving bed granular filter development at Combustion Power Company, 9:49390 (RA;US)
Guin, J.A., *See* Tarrer, A.R., 9:49355
Gujral, P.S., Evaluation of thermal energy conservation schemes for an experimental masonry building. Final report, 9:49689 (R;US)
Gul, S., Approach to neutronics analysis of CANDU reactors, 9:49781 (R;PK)
See Arshad, M., 9:49841
Gulden, W., *See* Bork, G., 9:49878
See Rininsland, H., 9:49864
Guntermann, K., *See* Breidung, P., 9:49367
Guo, C., *See* Bakalyar, D.M., 9:50513
Guosheng, Z., *See* Fauchet, P.M., 9:50253
Gupta, A., *See* Liang, R.H., 9:49631
Gupta, G.D., *See* Ahluwalia, K.S., 9:49675
Gupta, S., Models which allow a "new inflationary" universe history, 9:50708 (J;US)
Gupta, Y., Optimization of a-Si solar cell current collection, 9:49644 (BA;US)
Gurev, V., *See* Manushev, B., 9:50578
Gustinis, J., Southwest Thermal Mass Study, Tesuque Pueblo, New Mexico: the effect of envelope thermal mass on the heating energy use of eight test buildings in a high desert climate (September 1981-December 1982), 9:50005 (R;US)
Gutay, L.J., *See* Hirsch, A.S., 9:50868
Guttenplan, J.B., Effects of pH and structure on the mutagenic activity of N-nitroso compounds, 9:50644 (BA;US)
Gyorffy, B.L., Ferromagnetism in metals at finite temperatures, 9:50945 (R;US)
Gyuali, J., Crystallization of amorphous silicon films by pulsed ion beam annealing, 9:50233 (BA;NL)
Gyulassy, M., Signatures of new phenomena in ultrarelativistic nuclear collisions, 9:50921 (J;NL)

H

Haag, R., Quantum field theory in gravitational background, 9:50704 (R;AT)
Haas, S.M., *See* Alsmiller, R.G. Jr., 9:49461
Hackley, D., *See* Marston, P.G., 9:51041
Hadley, G.R., *See* Russo, A.J., 9:50139
Haefele, K., *See* Schoenauer, W., 9:50403
Hage, G.L., *See* Patrick, W.C., 9:49560
Hagen, S., Investigations on temperature escalation under severe fuel damage conditions, 9:49880 (RA;DE;In German)
Hahn, K., *See* Reineke, H.H., 9:49845
Haider, G., *See* Thomas, W., 9:49793
Haire, R.G., *See* Nave, S.E., 9:50102
Hajicek, D.R., Fluidized bed combustion of low-rank coals, 9:49429 (RA;US)
Hales, J.M., *See* Holdren, M.W., 9:50574
Hall, E.J., *See* Hei, T.K., 9:50616
Hallden, E., *See* Ljungberg, L., 9:49766
Ham, D., Hot-gas chloride cleanup for molten carbonate fuel cells, 9:49339 (RA;US)
Hama, H., *See* Tanaka, N., 9:50026
Hamblin, D.M., Impact analysis speculations regarding the Pacific Northwest Power Planning Council prescriptive building standards applied to the public utilities service area new housing starts, 9:49980 (R;US)
Hamdim, A.H., *See* Wilson, S.R., 9:50237
Hamel, W.R., Filling the gap through teleoperation, 9:50495 (R;US)
Hamm, R.N., Studies of charged-particle tracks in liquid water, 9:50926 (R;US)
Hamshar, J.A., Advanced research for the characterization of hydrogen donor solvents in two-stage liquefaction. Quarterly report, April 1, 1984-June 30, 1984, 9:49356 (R;US)
Handin, J., Transient creep of repository rocks. Mechanistic creep laws for rock salt. Final report, 9:50665 (R;US)
Hane, G.J., Assessment of technical strengths and information flow of energy conservation research in Japan. Volume 1. Executive summary, 9:49943 (R;US)
Haniger, L., *See* Lnenicka, B., 9:49819
Hansen, L.F., Tritium/deuterium gas cell, 9:50465 (R;US)

Hanson, A.D., Interpreting the metabolic responses of plants to water stress, 9:50588 (J;US)
Hanson, L.K., Spectral properties of protonated Schiff base porphyrins and chlorins. INDO-CI calculations and resonance raman studies, 9:50337 (J;US)
Hanson, R.L., *See* Cheng, Y.S., 9:50535
Hansson, B., Impact of risk studies, 9:49936 (R;SE)
See Dooley, J.E., 9:49935
Happel, H.W., *See* Dietrichs, H.J., 9:50069
Haraldsen, H.P., High reliability instrumentation systems, 9:50436 (R;NO;In Norwegian)
Harb, A., *See* Fu, K.C., 9:49737
Harbottle, G., *See* Hickman, D.A., 9:50294
Hardee, H.C., Heat-transfer measurements of the 1983 Kilauea lava flow, 9:49723 (J;US)
Hardin, J.M., *See* Kalkwarf, D.R., 9:49441
Hargrove, O.W., *See* Glover, R.L., 9:50438
Harker, P.T., *See* Friecsz, T.L., 9:50033
Harley, R.G., *See* Limebeer, D.J.N., 9:49762
Harms, N.L., *See* Byers, K.R., 9:49571
Harms, W.R., *See* Richter, D.D., 9:50545
Harnden, W., *See* Weres, O, 9:49477
Harper, J.P., *See* Solari, J.S., 9:50048
Harrigan, M.F., L subshell X-ray production by 100 to 250 keV/a.m.u. ions, 9:50734 (RA;AU)
Harrington, E.S., *See* Travis, C.C., 9:50636
Hart, R.E., *See* Weizer, V.G., 9:49613
Harter, J.A., *See* Valentine, K.H., 9:50490
Hartgen, D.T., *See* Erlbaum, N.S., 9:50031
Hashimoto, A.G., Economic optimization of anaerobic fermenter designs for beef production units, 9:49583 (BA;US)
Hasselman, D.P.H., *See* Bentsen, L.D., 9:50167
Hassenzahl, W.V., *See* Wu, I.W., 9:50141
Hassmann, K., Investigation of the meltdown accident with special regard to the radiological state of knowledge, 9:49847 (R;DE;In German)
Hastings, K.E., *See* Chillingworth, R.S., 9:49372
Hata, M., *See* Kajiura, S., 9:51044
Hattingen, U., Theoretical and experimental studies on the limits of capacity of the thermal reactor in after-treatment of exhaust gases, 9:50087 (R;DE;In German)
Haubelt, R., Studies on the 'air-grass-cow-milk' exposure pathway of airborne ^{131}I from Wuergassen nuclear power plant in the 1980 grazing season, 9:50560 (R;DE;In German)
Hauer, J.F., *See* Boenig, H.J., 9:49903
Hauserman, W.B., Low-rank coal/water slurry combustion, 9:49430 (RA;US)
Physical properties and moisture, 9:49381 (RA;US)
Hawken, P., Testing and computer simulation of an air based, solar assisted heat pump system, 9:49701 (BA;US)
Hawkins, W.G., *See* Biegelsen, D.K., 9:50226
See Nemanich, R.J., 9:50219
Hawthorne, A.R., *See* Vo-Dinh, T., 9:50494
Hayat, M.K., Description and repair procedure for optical digitizers PAC-4, 9:50500 (R;PK)
Hayes, J.K., *See* Jensen, R.J., 9:50309
Haynie, W.R., *See* Roll, J.B., 9:49987
Hazeltine, R.D., Shear-Alfven dynamics of toroidally confined plasmas. Part A, 9:51005 (R;US)
Shear-Alfven dynamics of toroidally confined plasmas. Part B, 9:51006 (R;US)
Head, J.D., *See* Hanson, L.K., 9:50337
Heath, M.J., Programme of research into the management and storage of radioactive waste. Fracture hydrology - Cornwall. Annual report 1983, 9:49527 (R;GB)
Heath, M.T., *See* Birdwell, J.D., 9:50378
See Laub, A.J., 9:50377
Hebbard, D.F., *See* Kondo, Y., 9:50852
Hecht, M.H., *See* Rothberg, G.M., 9:50304
Hecker, S.S., *See* Smith, J.L., 9:50132
Hedberg, S., *See* Becker, K.M., 9:49885
Hefka, R., *See* Moser, H., 9:50656
Hefta, R.S., *See* Schelkoph, G.M., 9:49335
Hegen, D., Study of the gas phase deposition of silicon carbide and its application for impregnation of reactively bound silicon carbide and for the manufacture of SiC/SiC composites, 9:50164 (R;DE;In German)
Hei, T.K., Effects of cellular non-protein sulfhydryl depletion in radiation induced oncogenic transformation and genotoxicity in mouse C_3H 10T1/2 cells, 9:50616 (J;US)
Heidel, C.C., *See* Pruett, D.P., 9:50366
Heidner, R., *See* Weiss, E., 9:49810
Heikhaus, H.H., Main characteristics of low-cost housing aimed at reducing energy consumption for heating. Final report, 9:50018 (R;LU;In French)
Hein, H., *See* Camara, A.S., 9:49510
Heineman, W.R., *See* Bandoli, G., 9:50354
Heinicke, W., Criticality experiments of the years 1981 and 1982, 9:49796 (R;DE;In German)
Heinig, K., *See* Dietrichs, H.J., 9:50069
Heller, R.W., Future hardware, 9:50381 (RA;US)
See Birdwell, J.D., 9:50378
Hellstrom, G., *See* Doughty, C., 9:49908
Hemmerich, R., Use of novel catalysts founded on basic-fixed hydride-carbonyl complexed for the Fischer-Tropsch synthesis, 9:49379 (R;DE;In German)
Henderson, R.F., *See* Mitchell, C.E., 9:50638
Henderson, T.R., *See* Bechtold, W.E., 9:50640
Hendrikson, J.G., Gasification wastewater treatment and reuse, 9:49331 (RA;US)
Henke, K.R., Waste characterization, 9:49427 (RA;US)
Henkes, T., *See* Achterberg, O., 9:50766, 9:50774
Henning, W., High-sensitivity mass spectrometry with a tandem accelerator, 9:50449 (J;IT)
Henry, E.B., CONTING Program Guide, 9:49765 (R;US)
Hentges, M., *See* Theilacker, J., 9:50470
Herbst, D., *See* Lemons, R.A., 9:50230
Herget, C.J., *See* Birdwell, J.D., 9:50380
Herrington, C., *See* Noufi, R., 9:49629
Herrmann, B., Dissolution of unirradiated UO_2-pellets in nitric acid, 9:49521 (R;DE;In German)
Hess, J.W., Geothermal environmental impact assessment: an approach to ground water impacts from development, conversion, and waste disposal, 9:50573 (R;US)
Hess, L.D., *See* Olson, G.L., 9:50244
Hesse, U., *See* Thomas, W., 9:49793
Hesse, W., Influence of loading rate on the fracture toughness vs. temperature curve, 9:50120 (RA;DE;In German)
Hester, R.D., *See* McCormick, C.L., 9:49447
Hetrick, D.M., *See* Travis, C.C., 9:50636
Heubeck, M., Report to the Shetland Oil Terminal Environmental Advisory Group on the 1982 and 1983 surveys of Eider moult flocks, 9:49462 (R;GB)
Report to the Shetland Oil Terminal Environmental Advisory Group on the Shetland Beached Bird Survey, March 1982-February 1983, 9:49464 (R;GB)
Report to the Shetland Oil Terminal Environmental Advisory Group on the Beached Bird Survey in Shetland, March 1980-February 1982, with a review of results since July 1978, 9:49465 (R;GB)
Hevesi, J., *See* Kozma, L., 9:50328
Hewett, C.A., *See* Gyuali, J., 9:50233
Hewett, D., Two-dimensional and relativistic effects in lower-hybrid current drive, 9:50987 (RA;GB)
Hibbard, W.R. Jr., Prospects for coal in America's energy future, 9:49413 (R;US)
Hickey, J.R., Passive exposure of Earth radiation budget experiment components (A0147), 9:50681 (R;US)
Hickey, S., *See* Wright, S., 9:50046
Hickman, D.A., Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Hickman, R.B., *See* Hoard, R.W., 9:51042
Hicks, G., Elastic scattering of γ-rays at small scattering angles, 9:50873 (RA;AU)
Higby, D.P., *See* Gillings, J.C., 9:49897
Higginbottom, P.R., *See* O'Connor, D.J., 9:50194
Highnote, R., Biogas curriculum: workshop, April 6-11, 1981, 9:49578 (R;US)
Hilal, M., *See* Arendt, F., 9:51034
Hilbert, C., dc SQUID as a tuned radiofrequency amplifier, 9:50373 (R;US)
Input impedance of an amplifier based on a dc superconducting quantum interference device, 9:50383 (J;US)
Hildebrandt, T., *See* Sievert, D., 9:49794
Hill, D., *See* Crabb, D.G., 9:50441
Hill, R.W., Centralia double module in situ coal gasification test conceptual design, 9:49362 (R;US)
Hill, V.L., Properties and performance of materials in the coal gasification environment, 9:49370 (B;US)
Hinde, D.J., Neutron emission from accelerating fission fragments, 9:50876 (RA;AU)
See Chatterjee, A., 9:50883
Hinds, N.R., *See* Hinds, W.T., 9:50550

Hinds, S., *See* Burnett, M., 9:50874
See Vermeer, W.J., 9:50841
Hinds, W.T., Impact of Lupinus leucophyllous on the nitrogen budgets of semi-arid plant communities, 9:50550 (R;US)
Hingerty, B., *See* Broyde, S., 9:50587
Hirsch, A.S., Description of fragmentation as a critical phenomenon in high energy p-nucleus collisions, 9:50868 (J;NL)
Hirschfeld, T., Feasibility of using fiber optics for monitoring groundwater contaminants, 9:50575 (J;US)
Feasibility of using fiber optics for monitoring ground water contaminants, 9:50580 (R;US)
Hirst, E., Conservation's value varies with view, 9:50024 (J;US)
Measuring effects of utility conservation programs: inputs to utility decision making, 9:50041 (RA;US)
Hizanidis, K., *See* Hewett, D., 9:50987
Ho, P.T.T., Entrainment/elutriation in fluidization and application in drying coal, 9:49420 (R;US)
Ho, T., Mutagenic activity of nitrosamines in mammalian cells: Study with the CHO/HGPRT and human leukocyte SCE assays, 9:50642 (BA;US)
Hoard, R.W., Analytical studies of advanced high-field designs: 20-Tesla large bore superconducting magnets, 9:51042 (J;FR)
Hobbs, C.H., *See* Cheng, Y.S., 9:50535
Hoche, A., Liquid gas operation, 9:50088 (RA;DD;In German)
Hodge, G.A., Fermilab central helium liquefier operations, 9:50467 (BA;US)
Hodson, J.S., *See* Allen, R.E., 9:49791
Hoegberg, T., *See* Alden, M., 9:50077
Hoek, J., *See* Lagerstedt, G., 9:49748
Hoeller, P., Detection and analysis of residual- and loading stresses in thick-walled components. State of research and development of the nondestructive methods, 9:49807 (RA;DE;In German)
Hoerl, E.M., *See* Semerad, E., 9:50749
Hoff, R.W., *See* Gardner, D.G., 9:50894
See Gardner, M.A., 9:50893
Hoffman, B., OTEC pilot plant for Kahe Point, Hawaii, 9:49680 (BA;US)
Hoffman, N.M., *See* Shirk, D.G., 9:50481
Hoffmann, R., *See* Sienko, M.J., 9:50182
Hofmann, A., Phase displacement acceleration in the SSC, 9:50454 (R;US)
Hofmann, D., *See* Sellin, I.A., 9:50725
Hofmann, I., Storage ring physics issues for GSI program, 9:50461 (R;DE)
Suppression of microwave instabilities, 9:50474 (R;DE)
Hofmann, P., *See* Dienst, W., 9:49867
Hohman, J.R., *See* Fox, M.A., 9:50330
Hohmann, G.L., *See* Raudenbush, M.H., 9:49562
Holder, G.D., Laboratory analysis of gas hydrate cores for evaluation of reservoir conditions. Final report, 9:49488 (R;US)
Holdren, M.W., Peroxyacetyl nitrate solubility and decomposition rate in acidic water, 9:50574 (J;GB)
Holl, H.B., Variable output coupler for laser cavities with totally reflecting mirrors, 9:50396 (P;US)
Holland, O.W., Ion beam processes in Si, 9:50184 (R;US)
See Appleton, B.R., 9:50099
Holm, D.D., Planar incompressible Yang-Mills magnetohydrodynamics, 9:50757 (J;IT)
Holman, G.D., Acceleration of runaway electrons and Joule heating in solar flares, 9:50682 (R;US)
Holman, G.S., *See* Lo, T.Y., 9:49890
Holman, R., Supersymmetric inflationary cosmology, 9:50669 (R;US)
Holmes, S.A., Nitrogen compound distribution in Eastern and Western U.S. shale oils produced by hydropyrolysis, 9:49503 (BA;US)
Holmstedt, T., *See* Alden, M., 9:50077
Holt, J.B., Synthesis of refractory materials, 9:50165 (P;US)
Holthoff, W.C., *See* Eriksaum, N.S., 9:50031
Holthuis, J.T., *See* Wu, I.W., 9:50141
Holton, G.A., *See* Travis, C.C., 9:50636
Holtzman, R.B., *See* Ter Haar, G.L., 9:50650
Honstetter, K., *See* Gindele, K., 9:49620
Hooke, W., *See* Motley, R., 9:50999
Hooker, C.D., *See* Gillings, J.C., 9:49897
Hoover, D.S., *See* Kang, D., 9:49346
Hopkins, R.H., *See* Rohatgi, A., 9:49635
Horner, D.A., Kinetics of oxygen exchange between bisulfite ion and water as studied by oxygen-17 nuclear magnetic resonance spectroscopy, 9:50302 (R;US)
Horsch, F., *See* Rininsland, H., 9:49864
Horton, J.A., Alloying effects and microstructure of iron aluminides, 9:50097 (R;US)
See Liu, C.T., 9:50106
Horton, L.L., Experimental determination of the critical cavity radius in Fe-10% Cr for ion irradiation, 9:50098 (R;US)
Horton, T.R., Methods and results of EPA's study of radon in drinking water, 9:50576 (R;US)
Horvai, R., *See* Kozma, L., 9:50328
Horwedel, J.E., *See* Alsmiller, R.G. Jr., 9:49461
Hosemann, J.P., *See* Bork, G., 9:49878
See Rininsland, H., 9:49864
Hotchkis, M.A.C., *See* Fifield, L.K., 9:50851
Hotchkis, M.A.S., *See* Drumm, P.V., 9:50839
Hotchkiss, G.B., Simulated performance of the Texas Instruments Solar Energy System in various U.S. cities, 9:49655 (BA;US)
Hotchkiss, M.A.C., Studies of very neutron-rich light nuclei using a gas target, 9:50860 (RA;AU)
Houlberg, W.A., Tritium pellet injection sequences for TFTR, 9:51024 (R;US)
Houle, F.A., *See* Schultz, J.C., 9:50357
Hovel, H.J., High-efficiency multi-colored photovoltaic cells. Final report, 9:49623 (R;US)
Howard, W.M., *See* Leander, G.A., 9:50905
See Mathews, G.J., 9:50703
Hoylman, E.W., *See* Everett, L.G., 9:50553
Hrehuss, G., Proposal for electron beam induced remote sensing x-ray fluorescence investigation of minor bodies in the solar system. Experiment IND-X, 9:50673 (R;HU)
Hsiao, T.P., *See* Chou, D.P., 9:50929
Hsie, A.W., *See* Ho, T., 9:50642
Hsieh, H.H., *See* Hwang, T.L., 9:50300
Hu, C., *See* Crowley, C.L., 9:50225
Hu, P.S., *See* Greene, D.L., 9:50032
Huang, J.C., *See* Lee, T.V., 9:50293
Hub, K., Evaluating applications of heat recovery incinerators: information and approaches, 9:50062 (R;US)
Huba, J.D., Influence of microturbulence on early time HANE structure. Memorandum report, 9:50818 (R;US)
Hubel, H., *See* Byrne, A.P., 9:50900, 9:50901
Huberman, E., Control of mutagenesis and cell differentiation in cultured human and rodent cells by chemicals that initiate or promote tumor formation, 9:50632 (R;US)
See Jones, C.A., 9:50643
Huey, H.E., *See* Jory, H.R., 9:51035
Huffstetler, J., *See* Gove, N.B., 9:49405
Hughes, J.P., A search for X-ray polarization in cosmic X-ray sources, 9:50699 (R;US)
Hugill, J., Dilution effect in beam-driven current experiments, 9:51015 (RA;GB)
Hulett, L.D., *See* Rosseel, T.M., 9:50149
Hulin, J., *See* Prokop, K., 9:49822, 9:50412
Hunsaenger, K.H., Water electrolysis using hybrid cyclic processes, 9:49574 (R;DE;In German)
Hunt, A.J., Carbon particles, 9:50214 (P;US)
Hunt, W.F. Jr., National air quality and emission trends report, 1982, 9:50531 (R;US)
Hunter, K., *See* Bircher, C., 9:49690
Huntington, S., Comments on coal conversion program, 9:49371 (BA;US)
Huray, P.G., *See* Nave, S.E., 9:50102
Hurley, G.F., Fabrication of SiC whiskers and composites, 9:50174 (R;US)
Hurley, J.P., *See* Benson, S.A., 9:49380
Hurley, K., *See* Pizzichini, G., 9:50713
Hurst, G.S., Feasibility of a $^{81}Br(\nu,e^-)$ ^{81}Kr solar neutrino experiment, 9:50706 (J;US)
See Iturbe, J., 9:50339
Hussain, S.D., Exploration for tritium-free water, 9:50352 (R;PK)
Preparation of radioactive tracer for studying sediment movement, 9:50668 (R;PK)
Program for TI programmable 59 calculator for calculation of ^3H concentration of water samples, 9:50351 (R;PK)
Purification of tritium-free water, 9:50353 (R;PK)
Hussung, R.O., *See* Kibbe, R.K., 9:51028
Hutchinson, D.P., *See* Casson, W.H., 9:51002
Hutchinson, R.A., *See* Hane, G.J., 9:49943
Hutton, P.H., Acoustic emission monitoring of ZB 1 intermediate scale vessel test, 9:49808 (RA;DE)
Hwang, T.L., Laboratory scale studies of $SiHCl_3$ synthesis, 9:50300 (R;TW;CH)
Hyland, S., Interaction between cast silicon properties and solar cell performance, 9:49632 (BA;US)

I

Icha, K., Position measurement of reactor control rods in start-up experiments, 9:49824 (RA;CS;In Czech)
Ichimura, A., *See* Bandoli, G., 9:50354
Iden, R., Fluorescent dyes for luminescent solar concentrators. Final report, 9:49703 (R;DE;In German)
Iferov, G.A., *See* Zhukova, Yu.N., 9:50931
Igenbergs, E., *See* Foote, J.H., 9:50680
Ihle, P., Heat transfer in rod bundles with severe clad deformations, 9:49871 (R;DE)
Iijima, H., *See* Yamazaki, O., 9:50025
Ikegami, R., *See* Brown, G.W., 9:50415
Il'in, S.I., *See* Denisov, F.P., 9:50951
Iles, P., *See* Hyland, S., 9:49632
Iles, P.A., Metallization problems with concentrator cells, 9:49616 (R;US)
Ilieva, K., *See* Khristov, V., 9:50930
Ilieva, N., Quantum effects in the Schwinger model, 9:50804 (RA;BG;In Bulgarian)
Imanishi, M., *See* Tanaka, N., 9:50026
Imhoff, K.L., State Energy Price System: 1982 update, 9:49952 (R;US)
Inguva, R., Dielectric properties of oil shale materials, 9:49501 (BA;US)
Inle, N.C., *See* Wolf, G.A., 9:50216
Inouye, H., Boron-induced toughness loss in Ti-6A1-2Nb-1Ta-0.8Mo, 9:50107 (R;US)
Ioki, Kimihoro, *See* Shibata, Keiichi, 9:50846
Iost, A., *See* Chermant, J.L., 9:50170
Irlweck, K., Uranium content in surface air in Vienna during the years 1963/64 and 1974 - 1978, 9:50541 (R;AT;In German)
Ishii, M., *See* De Jarlais, G., 9:50407
Ishmaev, S.N., *See* Svab, E., 9:50131
Iskander, S.K., *See* Jansky, J., 9:49805
Ito, Kazutoshi, Method for treatment of wastewater of nuclear power plants, 9:49832 (TG;US)
Iturbe, J., Fluctuation experiments on atomic and molecular systems using the one-atom detector, 9:50339 (J;NL)
Ivanov, A.E., *See* Vamberskii, I.V., 9:50150
Ivanov, I., *See* Bartke, E., 9:50478
Ivanov, O.S., *See* Vamberskii, I.V., 9:50150
Ivanovich, M., Uranium series disequilibrium measurements at MOL and Whiteshell. Annual progress report for 1983, 9:49530 (R;GB)
Iwasa, Y., *See* Luton, J.N., 9:51029
Izard, B.E., *See* Wilson, D.J., 9:50279

J

Jackson, P.O., *See* Kalkwarf, D.R., 9:49441
Jacobs, S.B., *See* Landis, J.W., 9:49876
Jacobson, D.B., Reactions of $FeCH_3^+$ and $CoCH_3^+$ with aliphatic alkanes in the gas phase, 9:50322 (J;US)
Reactions of $FeCH_3^+$ and $CoCH_3^+$ with cyclic hydrocarbons in the gas phase, 9:50323 (J;US)
Jacobson, D.C., *See* Clark, G.J., 9:50153
Jacobson, R.L., *See* Hess, J.W., 9:50573
Jacobus, M.J., Review of regulatory requirements governing control room habitability systems, 9:49827 (R;US)
Jaffe, L.D., Solar tests of aperture plate materials for solar thermal dish collectors, 9:49706 (R;US)
Jagannath, C., *See* Wolff, P.A., 9:50389
Jager, W., *See* Koske, P.H., 9:49525
Jahn, W., Special analyses of the temperature and fission product behaviour of HTR-MODUL plants, 9:49861 (R;DE;In German)
Jain, R., APT dry plate scrubber for particulate collection at high temperature and pressure, 9:49392 (RA;US)
Jalan, V., Metal/metal oxides as high temperature desulfurization sorbents, 9:49338 (RA;US)
James, J.V., *See* Bakalyar, D.M., 9:50513
James, P.W., Air quality monitoring at Sullom Voe using lichens as biological indicator species: results of the 1981 and 1982 repeat photographic surveys, 9:49466 (R;GB)
James, R.B., Electron-hole plasma formation in semiconductors due to the absorption of pulsed CO_2 laser light, 9:50944 (R;US)
Optically induced intervalence-band transitions in germanium by the absorption of 1.06 μm picosecond pulses, 9:50943 (R;US)
Janett, A., *See* Breunlich, W.H., 9:50752
Jani, P., *See* Bertolotti, M., 9:50251
Janosy, J.S., *See* Kolev, N.P., 9:49777
Jansky, J., Influence of material toughness on damage caused by thermal shock loading, 9:49805 (RA;DE;In German)
Jarvis, P.D., *See* Morrison, I., 9:50903
Jaschik, N.L., *See* Erlbaum, N.S., 9:50031
Jaus, W., Theoretical calculation of the forward cross section for deuteron photodisintegration at low energies, 9:50829 (RA;AU)
Jehn, U., *See* Glaser, E., 9:50200
Jelmert, T.A., Gas injection in heterogeneous reservoirs. Analytical solution No. 1, 9:49450 (R;NO)
Gas injection in heterogeneous reservoirs. Case study No. 1, 9:49451 (R;NO)
Jenne, E.A., Validation of geochemical models, 9:50667 (R;US)
Jennissen, J.J., Mathematical model to determine incorporated quantities of radioactivity from the measured photometric values of tritium-autoradiographs in neuroanatomy, 9:50592 (R;DE;In German)
Jensch, K., Analysis of the technical and energetical operation behavior of cogeneratiOn plants, 9:50053 (R;DE;In German)
Jensen, A.S., *See* Forster, J.S., 9:50892
Jensen, R.J., Method of separating boron isotopes, 9:50309 (P;US)
Jepson, B.E., Calcium hydroxide isotope effect in calcium isotope enrichment by ion exchange, 9:50311 (J;US)
Jeske, U., *See* Arendt, F., 9:51034
Jessberger, E., *See* Foote, J.H., 9:50680
Jewett, D.N., Progress in growth of silicon ribbon by a low angle, high rate process, 9:49633 (BA;US)
Jinte, Y., *See* Xiaoen, L., 9:50514
Jiranek, V., *See* Duchacek, V., 9:50269
Jobes, F., *See* Motley, R., 9:50999
Johnson, A.B. Jr., *See* Wheeler, K.R., 9:50156
Johnson, D.H., An artificial upwelling driven by salinity differences in the ocean, 9:49679 (BA;US)
See Leboeuf, C.M., 9:49712
Johnson, D.L., *See* Perlack, R.D., 9:49599
Johnson, D.W., Forest nutrient cycles as affected by climate, species composition, stand age, and intensive harvesting, 9:49605 (R;US)
Johnson, G.O., *See* McClish, R.F., 9:49491
Johnson, J.J., SSI sensitivity studies and model improvements for the US NRC Seismic Safety Margins Research Program. Rev. 1, 9:49902 (R;US)
Johnson, K.A., Metallographic grinding efficiency, 9:50414 (R;US)
See Craig, R.W., 9:49561
Johnson, N.M., *See* Biegelsen, D.K., 9:50226
Johnson, R.T., Improved spark ignition engine efficiency through lean turbocharged operation, 9:50084 (BA;US)
See Schmid, K.R., 9:50083
Johnson, S.T., *See* Brown, R.A., 9:50284
Johnson-Walls, P.E., *See* Wu, I.W., 9:50141
Jolin, L.J., *See* Foltyn, S.R., 9:50395
Jolley, R.L., Chemistry and fate of disinfection by-products, 9:50568 (R;US)
Jonah, C.D., Picosecond pulse radiolysis studies to understand the primary processes in radiolysis, 9:50346 (R;US)
Jones, C.A., The relationship between the carcinogenicity and mutagenicity of nitrosamines in a hepatocytemediated mutagenicity assay, 9:50643 (BA;US)
See Huberman, E., 9:50632
Jones, D.C., *See* Kleinpeter, J.A., 9:49375
Jones, G. II, Singlet sensitization of the norbornadiene rearrangement: excitation energy cascade potentially involving triplet exciplexes, 9:50345 (J;GB)
Wavelength effects on ionic photodissociation of charge-transfer complexes: the quadricyclene system, 9:50343 (J;NL)
Jones, M.B., *See* Baltisberger, R.J., 9:49353
Jones, M.C., *See* Booker, S.R., 9:50502
Jones, M.L., *See* Conn, R.E., 9:49377
See McCollor, D.P., 9:49428
Jones, M.M., *See* Wangen, L.E., 9:49407
Jones, V.T., Alaska Natural Gas Transportation System, 9:49485 (R;US)
Joos, H., *See* Goeckeler, M., 9:50800
Jordan, E.H., Elevated temperature biaxial fatigue, 9:50079 (R;US)
Jordan, T.M., *See* Mack, J.M., 9:50934
Jordanov, J., *See* Khristov, V., 9:50930
Jordanov, P., *See* Tsvetanov, P., 9:49924
Jorgensen, C.K., *See* Reisfeld, R., 9:49714
Jorgensen, J.D., *See* Brun, T.O., 9:49915
Jory, H.R., 60 GHz Gyrotron Development Program. Quarterly report No. 18, October-December 1983, 9:51035 (R;US)
Jukl, M., Computers in experimental nuclear power facilities, 9:49835 (RA;CS;In Czech)

Julisch, P., *See* Bernecker, G., 9:50117
Jung, J., Fusion reactor studies at Argonne National Laboratory. Present status of fusion researches in USA, (2), 9:51043 (J;JP;In Japanese)
Jury, J.W., *See* Zubanov, D., 9:50843

K

Kabel, R.L., *See* Sinn, J.P., 9:50639
Kadmenskij, A.G., Axial channeling in a thick monocrystal, 9:50947 (RA;SU;In Russian)
See Samarin, V.V., 9:50948
Kaempfer, B., *See* Barz, H.W., 9:50913
Kai, K., *See* Kane, S.R., 9:50687
Kaiser, M.L., *See* Desch, M.D., 9:50701
Kajiura, S., Heating and cooling systems for JT-60 Vacuum Vessel, 9:51044 (BA;US)
Kakos, S., *See* Bakalyar, D.M., 9:50513
Kalinkova, N., *See* Uzunov, I., 9:49826
Kalkwarf, D.R., Lung-clearance classification of radionuclides in coal fly ash, 9:49441 (J;GB)
Kalous, F., *See* Benes, S., 9:50267
Kalteis, H., *See* Schaudy, R., 9:50347, 9:50348
Kalvius, G.H., *See* Pinto, H., 9:50114
Kalwa, G., State of the development and applications-techniques of the steel X 20 CrMoV 12 1, 9:50115 (RA;DE;In German)
Kamat, P.V., *See* Fox, M.A., 9:50330
Kamber, P.D., *See* Malte, P.C., 9:49589
Kamelander, G., Physical models and numerical methods of the reactor dynamic computer program RETRAN, 9:49895 (R;AT;In German)
Kamgar, A., Linear zone-melt recrystallized Si films using incoherent light, 9:50154 (BA;NL)
Kamins, T.I., *See* Zorabedian, P., 9:50224
Kammash, T., Theoretical investigations relevant to magnetic fusion research, 9:51003 (R;US)
Theoretical investigations relevant to magnetic fusion research, April 1, 1983-March 31, 1984, 9:51004 (R;US)
Kammel, P., *See* Breunlich, W.H., 9:50752
Kampas, F.J., *See* Delahoy, A.E., 9:49646
Kandarian, R., *See* York, R.L., 9:50463
Kando, P.F., Industrial work on latent heat storage, 9:49718 (R;US)
Kane, J., *See* Catalano, A., 9:49651
Kane, P., BIOMOD - preliminary findings, 9:49537 (R;GB)
Development of the biosphere code BIOMOD: final report, 9:49535 (R;GB)
User's guide to the biosphere code BIOMOD, 9:49534 (R;GB)
See Coughtrey, P.J., 9:49536
Kane, S.R., Acceleration and confinement of energetic particles in the 7 June 1980 solar flare, 9:50687 (R;AU)
Kane, T., *See* Byer, R.L., 9:50519
Kang, D., Impact of hydrogen partial pressure on coal liquefaction. Final technical report, 9:49346 (R;US)
Kannberg, L.D., Field testing of aquifer thermal energy storage, 9:49910 (R;US)
Kaplan, S.M., High temperature gas turbine engine component materials testing program. Monthly technical progress report No. 5, November 1-29, 1975, 9:49328 (R;US)
Kaplin, V.V., Radiation at particle scattering in ultrathin crystals, 9:50952 (RA;SU;In Russian)
Kapusta, J.I., Nucleation rate for black holes, 9:50707 (J;US)
Karabsky, B., 4- atomism. One-dimensional potential dimple, 9:50962 (RA;BG;In Bulgarian)
Karaki, S., *See* Hawken, P., 9:49701
Karamanova, Zh., Energy dispersive X-ray elemental analysis for pigments identification of tempera painting, 9:50270 (RA;BG;In Bulgarian)
Karamyan, S.A., *See* Bugrov, V.N., 9:50127
Karastoyanov, A., Exponentially decreasing newtonian force in the place of Yukawa potential, 9:50898 (RA;BG;In Bulgarian)
Karl, H., *See* Gindele, K., 9:49620
Karmasin, K., *See* Prokop, K., 9:49818, 9:50412
Kaschiev, G., *See* Velkov, K., 9:49776
Kashdan, E.R., Review of recent research in indoor air quality. Final report October 1983-February 1984, 9:50533 (R;US)
Kashukeev, N., Electroneutrality of the neutron, 9:50769 (RA;BG;In Bulgarian)
Kaspersson, R., *See* Dooley, J.E., 9:49935
Kasten, P.R., *See* Gambill, W.R., 9:49795
Kasza, K.E., Improvement of the performance of solar energy or waste heat utilization systems by using phase-change slurry as an enhanced heat-transfer/storage fluid, 9:49710 (BA;US)
Katsaoka, T., *See* Colombo, L., 9:50254
Kathren, R.L., *See* Swint, M.J., 9:50623
Katkov, V.M., *See* Bajer, V.N., 9:50197, 9:50954
Katkovskij, E., *See* Kolev, N., 9:49799
Katryniok, D., High capacity batteries based on aluminum/oxygen cells, 9:49916 (TJ;US)
Katz, A.I., *See* Mills, R.L., 9:50202
Katz, W., *See* Liu, Y.S., 9:50234
Kaufman, A., Development of a simplified procedure for cyclic structural analysis, 9:50078 (R;US)
Kaufmann, P., *See* Costa, J.E.R., 9:50688
Kavanagh, K., *See* Gyuali, J., 9:50233
Kawaguchi, S., *See* Onodera, S., 9:50116
Keairns, D.L., *See* Ciliberti, D.F., 9:49394
Keane, A.T., *See* Rundo, J., 9:50608
Kechouane, M., *See* Barbier, D., 9:50232
Keener, T.C., Study of the reaction of SO_2 with $NaHCO_3$ and Na_2CO_3, 9:49403 (J;US)
Kelber, J.A., Electron-stimulated desorption from partially fluorinated hydrocarbon thin films: Molecules with common versus separate hydrogen and fluorine bonding sites, 9:50210 (J;US)
Kelly, K.E., Characterization of oil shale mine waters, central Piceance Basin, Colorado. Final report, 9:49505 (R;US)
Kelly, T.J., *See* ten Brink, H.M., 9:50520
Kemper, R.C., Responding to the conservation needs of low-income and multi-family residential customers, 9:49988 (RA;US)
Kendall, P.W., *See* Logee, T.L., 9:49692, 9:49693, 9:49694
Kenik, E.A., Application of extraction replicas and analytical electron microscopy to precipitate phase studies, 9:50100 (R;US)
Kennard, C.H.L., Neutron activation analysis on a series of human gallstones, 9:50272 (RA;AU)
Kenney, S.M., Failure mode analysis for lime/limestone FGD system. Volume III. Plant profiles. Part 1 of 3, 9:49401 (R;US)
Kenoyer, J.L., Evaluation of a draft standard on performance specifications for health physics instrumentation: results for environmental tests, 9:50486 (R;US)
Kerns, Q.A., High power radio frequency attenuation device, 9:50425 (P;US)
Kerwin-Peck, D., *See* Dienst, W., 9:49867
Kessler, K., *See* Weiss, E., 9:49810
Keville, R., *See* Hansen, L.F., 9:50465
Key, T., *See* Chu, D., 9:49657
Key, T.S., Residential photovoltaic power conditioning technology for grid connected applications, 9:49662 (BA;US)
Khalil, H., Evaluation of the core physics and safety characteristics of a quasi-homogeneous LMFBR concept, 9:49849 (R;US)
Khan, N.A., *See* Hussain, S.D., 9:50668
Khazan, S.M., *See* Rozhkov, V.V., 9:50738
Khondker, A.N., Conduction in polycrystalline silicon: generalized thermionic emission-diffusion theory and extended state mobility model, 9:50247 (BA;NL)
Khoze, V.A., Heavy quark physics, 9:50785 (RA;SU;In Russian)
Khriplovich, I.B., Superfluid ^{3}He. Neutral currents, T invariance, gravitation, 9:50755 (RA;SU;In Russian)
Khristov, Kh., Asymptotic functions - Fourier transformation, 9:50979 (RA;BG;In Bulgarian)
Khristov, V., Theoretical and experimental investigation on neutron transport in moderating and shielding materials, 9:50930 (RA;BG;In Bulgarian)
Khristova, B., *See* Radicheva, M., 9:49828
Kibbe, K., *See* Marston, P.G., 9:51041
Kibbe, R.K., Experience highlights from the design and manufacture of US LCT coils, 9:51028 (R;US)
Kiefer, H., Annual report 1983 of Hauptabteilung Sicherheit, 9:49874 (R;DE;In German)
Kiefner, J.F., Defect detection by acoustic emission. Part 2, 9:49486 (J;US)
Defect detection by acoustic emission. Part 1, 9:49487 (J;US)
Judging defect severity on offshore pipelines, 9:49471 (J;US)
Kielanowski, P., *See* Bohm, A., 9:50771
Kiessling, F., Modelling of the overall aeroelastic system of a windturbine aided by symbolic programming, 9:49733 (R;DE;In German)
Kilb, R.W., E-fields parallel-to-b effects on plasma shear across magnetic flux tubes. Technical report, 9:50510 (R;US)

Killinger, D.K., *See* Menyuk, N., 9:50518
Kim, D.M., *See* Khondker, A.N., 9:50247
Kim, S.H., Subcable test facility, 9:51030 (R;US)
Kimble, P.F., *See* Paciorek, K.L., 9:49506
Kimmel, B.L., Size distribution of planktonic autotrophy and microheterotrophy in DeGray Reservoir, Arkansas, 9:50564 (R;US)
Kimura, C.Y., Categorization of PWR accident sequences and guidelines for fault trees: seismic initiators, 9:49901 (R;US)
King, C.J., Proceedings of the third biennial synfuels wastewater workshop, 9:49387 (R;US)
King, G.B., Saturated laser fluorescence in turbulent sooting flames at high pressure, 9:50356 (R;US)
King, L.J., Transuranium Processing Plant report of production, status, and plans for October 1, 1980-March 31, 1983, 9:50350 (R;US)
Kinneman, W.P., *See* McCollor, D.P., 9:49428
Kirby, B.J., *See* Sealock, R.M., 9:50275
Kirby, R.E., *See* Garwin, E.L., 9:50140
Kirk, B.L., Beginner's guide to blocked records on magnetic tape, 9:51058 (R;US)
Kirsch, F.W., Energy management assistance for small and medium-size manufacturers. A first-stage evaluation of the 1981-1983 program, 9:49975 (R;US)
Implementation results and financial returns from EADCS' recommendations to conserve energy and control costs. Third phase, 1981-1983 program, 9:49971 (R;US)
Implementation results and financial returns from EADCs' recommendations to conserve energy and control costs. Second phase, 1981-1983 program, 9:49973 (R;US)
Implementation of energy conservation opportunities by small and medium-size manufacturers. Second phase, 1981-1983 EADC program, 9:49976 (R;US)
Implementation of EADCs' recommendations to conserve energy and save dollars (1981-1982), 9:49978 (R;US)
Manufacturing costs, equipment needs and technological opportunities among small and medium-size manufacturers, 9:50034 (R;US)
See Duke, L.D., 9:49979
Kirschfink, F.J., *See* Althoff, M., 9:50763, 9:50764, 9:50765
Kissinger, H.E., *See* Brimhall, J.L., 9:50138
Kittel, G., Diesel engine for passenger cars with and without supercharging, 9:50070 (RA;DD;In German)
Klainer, S., *See* Hirschfeld, T., 9:50575
Klainer, S.M., *See* Hirschfeld, T., 9:50580
Klebesadel, R.W., *See* Pizzichini, G., 9:50713
Klein, A., Microwave moisture-meter, 9:49419 (R;DE;In German)
Klein, J.A., Health and environmental monitoring at the University of Minnesota-Duluth coal gasification facility. Draft, 9:49404 (R;US)
Klein, J.W., *See* Key, T.S., 9:49662
Kleinpeter, J.A., Coal liquefaction and deashing studies--2. Solvent refined coal process, 9:49375 (J;US)
Kleiss, R., *See* Berends, F.A., 9:50772, 9:50773
Klimczak, G.W., *See* Thomas, G.E., 9:50460
Klots, C.E., Effects of dc electric fields on multiphoton ionization spectra in cesium, 9:50726 (R;US)
See Compton, R.N., 9:50721
Klovning, A., *See* Berger, C., 9:50767
Kluge, H., *See* Decman, D.J., 9:50897
Klusek, C.S., Strontium-90 in the US diet, 1982, 9:50557 (R;US)
Knapp, F.F. Jr., Design and biological properties of iodine-123 labeled β-methyl-branched fatty acids, 9:50589 (R;US)
Knapp, G.S., *See* Nevitt, M.V., 9:50185
Knapp, J.A., Growth of silicon-on-insulator films using a line-source electron beam, 9:50228 (BA;NL)
Knapp, R.C. Jr., *See* Logee, T.L., 9:49692
Knobeloch, G.W., *See* Perrin, R.E., 9:50290
Knobus, B., *See* Sahre, P., 9:50543
Knoell, R., *See* Kamgar, A., 9:50154
Knotek, M.L., *See* Kelber, J.A., 9:50210
Knotik, K., Immobilization of toxic waste by embedding into bitumen, 9:50057 (R;AT;In German)
Knutson, A., *See* Kramer, C.F., 9:50629
Kocandrle, L., *See* Lnenicka, B., 9:49819
Koch, C.C., *See* Horton, J.A., 9:50097
Kocher, D.C., Perspective on demonstrations of compliance for high-level waste disposal, 9:49540 (R;US)
Kochman, M.P., Low-cost approach to local government energy contingency planning, 9:49947 (R;US)
Kockelmann, H., *See* Roos, E., 9:49809
Koda, T., *See* Kajiura, S., 9:51044
Koehl, M., *See* Gindele, K., 9:49620
Koehmstedt, P.L., Self-contained exothermic applicator and process, 9:50384 (P;US)
Koelzer, W., *See* Kiefer, H., 9:49874
Koenig, L.A., *See* Kiefer, H., 9:49874
Koinig, H., *See* Kamelander, G., 9:49895
Koizumi, K., *See* Luton, J.N., 9:51029
Kokorowski, S.A., *See* Olson, G.L., 9:50244
Kolb, J., *See* Bircher, C., 9:49690
Kolev, N., Computer-aided core surveillance: a conceptual study for WWER type reactors, 9:49825 (RA;BG;In Bulgarian)
Efficient numerical methods for analysis of nuclear reactor thermohydraulics, 9:49799 (RA;BG;In Bulgarian)
See Velkov, K., 9:49776
Kolev, N.P., Simulation of the dynamic behaviour of the primary circuit in a WWER-440 type nuclear power plant Pt. 1, 9:49777 (R;HU)
Komarek, P., *See* Arendt, F., 9:51034
See Marston, P.G., 9:51041
Kondo, Y., Coupled channels description of resonant structures in the $^{16}O + ^{20}Ne$ system, 9:50849 (RA;AU)
Parity-dependence of the nucleus-nucleus potential and $^{16}O + ^{24}Mg$ elastic scattering at theta sub(c.m.)=90°, 9:50852 (RA;AU)
Resonant structures in the $^{20}Ne(^{16}O,^{12}C)^{24}Mg$ reaction, 9:50850 (RA;AU)
Konig, V., *See* Ulbricht, J., 9:50832
Kooper, W.F., Waste disposal sites and their effect on the quality of ground water: a study of literature, 9:50570 (R;NL;In Dutch)
Kopp, M.K., *See* Valentine, K.H., 9:50490
Koppel, L., *See* Wong, S., 9:50394
Koppenaal, D.W., *See* Bland, A.E., 9:49494
See Robl, T.L., 9:49492
Kornegay, B., *See* Frischknecht, F.C., 9:50664
Kortright, J.B., Structural studies of amorphous Mo-Ge alloys using synchrotron radiation, 9:50110 (R;US)
Kosev, N., Model for the mechanism of stabilization of the Mn-56 "hot" atom and the obtaining of its different valent forms through the (n,) reaction in solid $KMnO_4$, 9:50349 (RA;BG;In Bulgarian)
Koske, P.H., Absorber loop concept for the contact between seawater and adsorber granulate, 9:49513 (R;DE)
Design of a modular pilot plant based on the adsorber loop concept, 9:49514 (R;DE)
Influence of adsorber performance on plant design for the extraction of uranium from seawater, 9:49508 (R;DE)
Some economic considerations for a pilot plant based on the adsorber loop concept, 9:49525 (R;DE)
Kosse, A.I., *See* Burenkov, A.F., 9:50124
Kosugi, T., *See* Kane, S.R., 9:50687
Kovacs, Z., Automatic construction of failure tree for reliability analysis of nuclear power plants, 9:49858 (RA;CS;In Slovak)
Kovaleva, E.A., Punch-through of atomic planes at a shallow incidence angle of proton beam, 9:50739 (RA;SU;In Russian)
Kozhukharov, I., *See* Manushev, B., 9:50578
Kozlov, M.G., *See* Gorshkov, V.G., 9:50735
Kozlovsky, B., *See* Ramaty, R., 9:50693
Kozma, L., Concerning the question of the fluorescence yield of solutions, 9:50328 (TJ;US)
Krach, F., Explosive safety criteria at a Department of Energy contractor facility, 9:50419 (R;US)
Kramer, C.F., Health effects of risk-assessment categories, 9:50629 (R;US)
Kramer, S.D., *See* Hurst, G.S., 9:50706
Krapchev, V., *See* Hewett, D., 9:50987
Kratzer, R.H., *See* Paciorek, K.L., 9:49506
Krause, H.F., *See* Rosseel, T.M., 9:50149
Krause, L.J., Electroless metal plating of plastics, 9:50179 (P;US)
Krause, M.O., Electron spectrometry experiments with the use of synchrotron radiation, 9:50722 (R;US)
Kraushaar, W.L., *See* Burrows, D.N., 9:50691
Krauthamer, S., Photovoltaic power conditioning subsystem: state of the art and development opportunities, 9:49654 (R;US)
Kreitmayr, U., *See* Foote, J.H., 9:50680
Kress, T.S., Review of areas that may require simultaneous coupled solution of the thermal hydraulic and fission product/aerosol behavior equations

for source term determination, 9:49853 (R;US)
Krieg, R., *See* Olausson, L., 9:49406
Krischan, J., *See* Patek, P., 9:49553
Kritz, A.H., Runaways and current drive, 9:50989 (RA;GB)
Kroodsma, R.L., Bird communities and vegetation structure in pine plantations of the southeastern Coastal Plain, 9:50546 (R;US)
Krug, W., *See* Borchardt, G., 9:49837
Krupka, K.M., *See* Jenne, E.A., 9:50667
Krymova, A.I., *See* Derkacheva, L.D., 9:50344
Kuban, D.P., Dual arm master controller concept, 9:49515 (R;US)
Kuby, W., Testing and evaluation of on-farm alcohol production facilities. Final report, 9:49585 (R;US)
See Chang, R., 9:49395
Kucera, J., Recording and evaluation of maintenance and repair jobs in nuclear power plants, 9:49811 (RA;CS;In Slovak)
Kuczera, H., *See* Foote, J.H., 9:50680
Kuentscher, V., Prospects of the otto-engine with carburetor, fuel injection and stratified charge, 9:50073 (RA;DD;In German)
Kukacka, L.E., *See* Sugama, T., 9:50172
Kuklik, B., Reliability analysis of LR-0 reactor accident alarm system, 9:49859 (RA;CS;In Czech)
Kulacki, F.A., *See* Mintzer, O., 9:50002
Kulcinski, G.L., *See* Badger, B., 9:51033
Kumar, K.S., Testing and evaluation of ESP at Curtiss-Wright, 9:49754 (RA;US)
Kumar, R., *See* Ruff, R.E., 9:50528
Kupershmidt, B.A., *See* Holm, D.D., 9:50757
Kurck, J., *See* Breunlich, W.H., 9:50752
Kuril'chik, E.V., *See* Pavlov, P.V., 9:50128
Kurka, J., *See* Kuklik, B., 9:49859
Kurth, M., *See* Breidung, P., 9:49367
Kurtz, R.J., *See* Hutton, P.H., 9:49808
Kutal, C., *See* Segers, D.P., 9:50305
Kutzner, H.J., *See* Claus, G., 9:50598
Kypreos, S., Cost-optimized energy supply scenarios for Switzerland and their political marginal conditions, 9:49919 (R;CH;In German)
Kyrala, G.A., Simulation of bent crystal spectrometers, 9:50499 (R;US)

L

Labzovskij, L.N., *See* Gorshkov, V.G., 9:50735
Lackas, W., *See* Berger, C., 9:50767
Lackey, W.J., *See* Stinton, D.P., 9:50173
LaCount, D.F., *See* Burgess, V.E., 9:50054
Laegsgard, E., *See* Forster, J.S., 9:50892
Lagerstedt, G., Cost of coal-fired plants and related equipment for environmental protection, 9:49748 (R;SE;In Swedish)
Laheld, P., *See* Corneliussen, C, 9:49453
Lahoud, M.A., *See* Limebeer, D.J.N., 9:49762
Lai, G.H., *See* Chou, D.P., 9:50929
Lallement, R., Existence and structure of rare earth monocarbides: study of their magnetic properties at low temperatures, 9:50171 (TG;US)
Lam, J.F., Locking of diode gain modules using optical conjugation techniques. Final report 1 August 1982-30 September 1983, 9:50392 (R;US)
Lam, N.Q., Radiation-induced compositional redistribution and local phase transformation in irradiated alloys, 9:50101 (R;US)
Lambarski, T.J., Estimation of magnitude and frequency of occurrence of high cell temperatures in reverse bias, 9:49641 (BA;US)
Lance, E.D., *See* Corbett, B.L., 9:49838
Landecker, P.B., *See* Kane, S.R., 9:50687
Lander, G.H., Summary of position-sensitive detector workshop Institut Laue-Langevin, Grenoble, France 11-12 October 1982, 9:50493 (BA;GB)
Landerman, E.I., Evaluation of low-cobalt alloys for hardfacing applications in nuclear components. Final report, 9:49803 (R;US)
Landis, J.W., Engineer-constructor's view of nuclear power plant safety, 9:49876 (RA;DE)
Landowne, S., *See* Lenske, H., 9:50857
Landry, E.F., *See* Vaughn, J.M., 9:50566
Langebrake, C.O., Rotary shaft seal, 9:50428 (P;US)
Langer, T., Some self-dual SO(3) solutions of the Yang-Mills equation and a note on harmonic maps, 9:50816 (D;US)
Langlois, J., Absorption of ^{45}Ca during the immersion of the aerial organs of Salicornia stricta, 9:50603 (R;FR;FR)
Langtry, T.M., Carbonate bodies within the basal swift formation (Jurassic) of northwestern North Dakota. Report of investigation No. 81, 9:50660 (R;US)
Lanier, W.S., *See* Mulholland, J.A., 9:50434
Lanius, K., Experimental neutrino physics at Serpukhov, 9:50768 (RA;BG)
Larash, R.C., *See* Francis, C.E., 9:49683
Laret, L., *See* Heikhaus, H.H., 9:50018
Laros, J.G., *See* Pizzichini, G., 9:50713
Larsen, D., *See* Soerensen, J.L., 9:49397
Larsen, E.M., *See* Badger, B., 9:51033
Larsen, P., *See* Soerensen, J.L., 9:49396
LaRue, R.D., *See* Mintzer, O., 9:50002
Lasaki, G.O., Design of a field experiment for air-steam co-injection for oil recovery in a Utah tar sand, 9:49500 (J;US)
Lasswell, P.G., *See* Phillips, J.E., 9:49639
Later, D.L., *See* Pelroy, R.A., 9:50637
Lathrop, J.W., Accelerated degradation of silicon metallization systems, 9:49614 (R;US)
Latz, R., *See* Sellin, I.A., 9:50725
Laub, A.J., Core numerical library, 9:50377 (RA;US)
See Birdwell, J.D., 9:50378, 9:50380
Lauf, R.J., *See* Stinton, D.P., 9:50173
Laughlin, G.J., *See* Gillings, J.C., 9:49897
Laugier, A., *See* Barbier, D., 9:50232
Lauppe, W.D., *See* Mueller, R., 9:49569
Laurence, J.A., Effects of sulfur dioxide on expansion of lesions caused by Corynebacterium nebraskense in maize and by Xanthomonas phaseoli var. sojensis in soybean, 9:50649 (J;US)
Laurendeau, N.M., *See* King, G.B., 9:50356
Lawrence, J.H., *See* Woodruff, K.H., 9:50626
Lay, B., Inelastic scattering of intermediate energy protons from tungsten, 9:50885 (RA;AU)
Leahy, W.M., EnergyCHECK commercial/industrial energy audit program, 9:50049 (RA;US)
Leander, G.A., Calculated masses and half-lives for nuclei in the region $100 \leq Z \leq 110$, 9:50905 (R;US)
Lebedev, N.Yu., *See* Kadmenskij, A.G., 9:50947
Lebel, J.L., *See* Dagle, G.E., 9:50621
Leber, R.L., *See* Hoard, R.W., 9:51042
LeBlanc, O., *See* Christensen, D.K., 9:49393
Leboeuf, C.M., Effect of soil conditions on solar pond performance, 9:49712 (BA;US)
Lebrun, J., *See* Heikhaus, H.H., 9:50018
LeBrun, T.J., Thermal treatment of municipal sewage sludges, 9:50551 (R;US)
Lee, D.A., Separation of lithium ions by chromatography, 9:50259 (R;US)
Lee, I.Y., *See* Ruff, R.E., 9:50528
Lee, J.D., *See* Hoard, R.W., 9:51042
Lee, M.M., *See* Beno, M.A., 9:50315
Lee, R.L., *See* Gresho, P.M., 9:50758
Lee, T.S.H., Meson-exchange Hamiltonian for nucleon-nucleon scattering up to 2 GeV, 9:50791 (BA;NL)
Lee, T.V., Separation factor method for the analysis of ideal binary mixtures in gas-solid adsorption, 9:50293 (J;US)
Lee, Y.N., *See* ten Brink, H.M., 9:50520
Lee, Y.T., *See* Baseman, R.J., 9:50321
Legge, G.J.F., Scanning proton microprobe and its place in elemental microanalysis, 9:50271 (RA;AU)
See Mazzolini, A.P., 9:50276
See O'Brien, P.M., 9:50277
See Sealock, R.M., 9:50275
Lehenbauer, G.W., Utility financing of energy management: the Puget Sound Power and Light experience, 9:49986 (RA;US)
Lehman, G.L., *See* Sklad, P.S., 9:50158
Lehner, G., *See* Gindele, K., 9:49620
Leibowitz, H.M., Gas turbine topping cycle industrial cogeneration system. Annual report January-December 1983, 9:50058 (R;US)
Leigh, J.R., *See* Chatterjee, A., 9:50883
Leigh, R.W., Photovoltaic-electrolyzer system transient simulation results, 9:49656 (BA;US)
Leitner, A., *See* Duftschmid, K.E., 9:50940
Lemal, B., Biomethanization plant in Baillonville, 9:49580 (R;LU)
Lemons, R.A., Crystallization of silicon films on glass: A comparison of methods, 9:50230 (BA;NL)
Lenkajt, K., *See* Bulgakov, Yu.V., 9:50196
Lenske, H., Direct reaction analysis of heavy ion collision from the quasi-elastic to the deep-inelastic regime, 9:50857 (RA;AU)
Lenz, E., *See* Miksch, M., 9:49767
Leray, C., *See* Bouree, J.E., 9:50250
Leschner, D.J., *See* Celler, H.K., 9:50229
Leung, D., *See* Hyland, S., 9:49632
Leung, H., *See* Reichert, J.D., 9:49713
Levander, T., *See* Olausson, L., 9:49406
Levanon, H., *See* Subramanian, R., 9:50341
Levi, S., *See* Gelev, M., 9:49831
Levine, J.D., *See* Mckee, W.R., 9:49677

Levine, L.O., Monitoring technology trends with patent data: fouling of heat exchangers. A case study, 9:50061 (R;US)
Levy, A., *See* Wakefield, R.A., 9:49961
Lewis, J. Jr., *See* Wrenn, G.E. Jr., 9:50215
Lewis, M.A., *See* Jonah, C.D., 9:50346
Lewis, M.B., *See* McHargue, C.J., 9:50159, 9:50160
Lewis, P.M., *See* Hane, G.J., 9:49943
Li, A.P., *See* Bechtold, W.E., 9:50640
Li, J.C., *See* Colombo, L., 9:50254
Li, J.C.M., Dislocation theory, 9:50181 (BA;FR)
Internal stresses, 9:50255 (BA;FR)
Liang, E.P., Emission model of gamma-ray bursts, 9:50698 (R;US)
Liang, K.S., *See* Safinya, C.R., 9:50320
Liang, R.H., Polymers in solar energy utilization, 9:49631 (BA;US)
Libson, K., *See* Bandoli, G., 9:50354
Lieberman, M.A., *See* Schaefer, J.F., 9:49661
Liem, H., Studies on the leaching and weathering processes of coal ashes, 9:49398 (R;SE;In Swedish)
Liepins, G.E., Recent advances in data compression, 9:51050 (R;US)
Liers, H., *See* Gupta, Y., 9:49644
Ligteringen, J., Medical inspection according to the new nuclear power law, 9:49930 (RA;NL;In Dutch)
Liles, D., *See* Steinke, R., 9:49886
Liljeblad, H., *See* Delhen, R., 9:49920
Lillestoel, E., *See* Berger, C., 9:50767
Limaye, D.R., *See* Davis, T.D., 9:50042
Limebeer, D.J.N., Laboratory measurements of subsynchronous resonance, 9:49762 (R;ZA)
Lin, S.C., Study of avalanche discharge lasers. Final technical report 1 July 1975-30 September 1983, 9:50391 (R;US)
Lincincome, T., *See* Theilacker, J., 9:50471
Lindau, I., *See* Rothberg, G.M., 9:50304
Lindberg, S.E., Recent field studies of dry deposition to surfaces in plant canopies, 9:50522 (R;US)
Lindenberger, H., *See* Schueck, C., 9:50896
Linder, G., *See* Camara, A.S., 9:49510
Lindler, K.W., *See* Anand, D.K., 9:49699
Lindstrom, P.J., *See* Olson, D.L., 9:50482
Linehan, J., *See* De Jarlais, G., 9:50407
Ling, C.H., *See* Becker, K.M., 9:49885
Lingenfelter, R.E., *See* Ramaty, R., 9:50693
Linhardt, H.D., Design and development of a high temperature particle separator for particle control in coal gasification plants, 9:49344 (RA;US)
Linklater, H., *See* Wilson, D.J., 9:50279
Lipfert, F.W., Mortality and air pollution: lessons from statistics, 9:50647 (J;NL)
Lippert, T.E., Testing and verification of granular bed filters for removal of particulates and alkalis, 9:49389 (RA;US)
Litt, M.H., New polymer electrodes and conductors based on poly(hydroquinone/quinone) oxidation/reduction systems. Technical progress report, 9:50176 (R;US)
Litzen, K.A., *See* Lagerstedt, G., 9:49748
Liu, C.S., *See* Chan, V.S., 9:50986
Liu, C.T., Design of ordered intermetallic alloys for high-temperature structural use, 9:50096 (R;US)
Role of boron additions on grain-boundary chemistry and tensile properties of Ni_3Al containing 24 and 26 at. % Al, 9:50106 (R;US)
See Horton, J.A., 9:50097
See Rosseel, T.M., 9:50149
Liu, G., Calculation and computer simulation of the Paraboloidal Mirror Analyzer (PMA), 9:50746 (R;US)
Liu, L.C., Contributions of pair correlations to pion-nucleus double charge exchange, 9:50916 (R;US)
Liu, Y.S., Transient annealing of ion-implanted silicon using a scanning IR line source, 9:50234 (BA;NL)
See Possin, G.E., 9:50227
Ljungberg, L., BWR water chemistry impurity studies: literature review of effects on stress corrosion cracking, 9:49766 (R;US)
Lloyd, B., Lower hybrid current drive experiments on the Alcator C and the Versator II tokamaks, 9:50997 (RA;GB)
Lnenicka, B., Control and testing unit for linear stepping drive of WWER 1000 reactor regulating rod, 9:49819 (RA;CS;In Czech)
Lo, T.Y., Probability of pipe failure in the reactor coolant loops of Combustion Engineering PWR plants. Volume 2. Pipe failure induced by crack growth, 9:49890 (R;US)
Locher, J.W., *See* Jewett, D.N., 9:49633
Lockwood, G.J., *See* Chang, J., 9:50501
Loehberg, R., *See* Miksch, M., 9:49767
See Schmidt, T., 9:50122
Logan, B.G., *See* Campbell, R.B., 9:51012
Logee, T.L., Actual versus design performance of solar systems in the National Solar Data Network, 9:49694 (R;US)
Component report performance of solar collector arrays and collector controllers in the National Solar Data Network, 9:49693 (R;US)
Survey of remote data monitoring systems, 9:49692 (R;US)
Lommel, L., *See* Tobias, C.A., 9:50627
Long, F.G., *See* Bean, V.E., 9:49424
Long, K.S., *See* Hughes, J.P., 9:50699
Loperena, G.A., *See* Dickson, E.M., 9:49735
Lopez, J.A., *See* Bechtold, W.E., 9:50640
Lopez, J.J., *See* Graf, J.M., 9:49932
Lopez, N., *See* Jory, H.R., 9:51035
Lord, G., *See* Ham, D., 9:49339
Lorenz, J.C., Compound structural history of Sweetgrass arch, northwestern Montana, 9:50662 (J;US)
Laramide interactions of structural elements in southwestern Montana, 9:50663 (J;US)
See Rutledge, A.K., 9:49445
See Teufel, L.W., 9:49476
Louveaux, F., *See* Schepens, G., 9:49960
Lovell, M.A., Remote assessment of permeability/thermal diffusivity of consolidated clay sediments, 9:49551 (R;GB)
Lovett, G.M., *See* Lindberg, S.E., 9:50522
Lu, C., Manual of phosphoric acid fuel cell power plant cost model and computer program. Final report, 9:49965 (R;US)
Lu, K.T., *See* Clark, C.W., 9:50753
Lubell, M.S., *See* Luton, J.N., 9:51029
Lucas, H.F., *See* Rundo, J., 9:50608
Lucas, H.F. Jr., *See* Ter Haar, G.L., 9:50650
Lucha, W., *See* Falkensteiner, F., 9:50786
Lucovsky, G., Amorphous materials and recrystallization, 9:50420 (R;US)
Ludowise, M.J., *See* Bhattacharya, P.K., 9:50213
See Boettcher, R.J., 9:49652
Ludwig, A., *See* Geiss, M., 9:49879
Ludwig, F.L., *See* Ruff, R.E., 9:50528
Lue, J.W., *See* Luton, J.N., 9:51029
Luebelsmeyer, K., *See* Althoff, M., 9:50763, 9:50764, 9:50765
Luescher, M., *See* Weisz, P., 9:50802
Luhmann, J.G., Characteristics of the magnetospheric source of interplanetary energetic particles, 9:50716 (R;US)
See Russell, C.T., 9:50686
Lukacs, B., Electrovac solutions with common shearing geodesic eigenrays, 9:50964 (R;HU)
Volume corrections for the specific entropy in nucleon-deuteron mixtures, 9:50914 (R;HU)
See Barz, H.W., 9:50913
Lula, J.W., Method and composition for molding low density desiccant syntactic foam articles, 9:50180 (P;US)
Lummus, C.E., Calciner unit SRC-I Coal Refinery, Newman, Kentucky: design baseline. Revision 1, 9:49348 (R;US)
Lund, P.D., Computational simulation of solar heating systems with seasonal heat storage, 9:49719 (R;FI)
See Peltola, S.S., 9:49720
Lundgren, T., *See* Lagerstedt, G., 9:49748
Lundin, R., *See* Pissarenko, N.F., 9:50683
Lundtveit, T., Safety requirements for wiring systems and connectors for photovoltaic systems. Final report, 9:49608 (R;US)
Lunnan, A.: Sandberg, E., Economic evaluation of a district heating plant in Trysil, 9:49925 (R;NO;In Norwegian)
Luoma, W.L., *See* Breault, R.D., 9:49962
Lusk, E., *See* Coultis, D., 9:51049
Luther, F.M., *See* Wuebbles, D.J., 9:50526
Luton, J.N., Preliminary results of the partial array LCT coil tests, 9:51029 (R;US)
Lutz, R. von, Studies on load management in the range of minute-to-minute up to hour-to-hour planning by means of dynamic optimization, 9:49760 (R;DE;In German)
Lyke, S.E., Development of a hot gas cleanup system for integrated coal gasification/molten carbonate fuel cell power plants, 9:49341 (RA;US)
Equilibrium measurements for the absorption of H_2S, COS and HCl by alkali metal carbonates, 9:49368 (J;US)
Lyman, J.T., *See* Woodruff, K.H., 9:50626
Lyon, W.S., Accelerating beta decay rates, 9:50918 (J;CH)

M

Ma, C.H., *See* Casson, W.H., 9:51002

Maas, D.J., *See* Baker, G.G., 9:49421
Macauley, M.K., Geographic variation in fuel flexibility: implications for the regional incidence of oil supply disruptions, 9:49460 (R;US)
See Toman, M.A., 9:49458
MacCracken, M.C., *See* Wuebbles, D.J., 9:50526
MacDonald, A.H., Edge states and quantized Hall conductivity in a periodic potential, 9:50144 (J;US)
MacDonald, M., *See* Bircher, C., 9:49690
MacDonald, R.J., Low energy ion beam interaction with surfaces and the application to surface analysis, 9:50193 (RA;AU)
See O'Connor, D.J., 9:50194
MacGill, R.A., *See* Brown, I.G., 9:50743
Macias, E.S., *See* Meyer, R.A., 9:50881
Macie. T., *See* Krauthamer, S., 9:49654
Maciejewski, M.L., *See* Maroni, V.A., 9:50331
Mack, J.M., Monte Carlo simulation of electron/photon/Cherenkov cascades in generalized geometry, 9:50934 (J;US)
MacLellan, J.A., *See* Gillings, J.C., 9:49897
Madey, J.M.J., Experimental investigation of the characteristics of an ultraviolet storage ring laser, 9:50475 (R;US)
Madey, R., *See* Lee, T.V., 9:50293
Maginn, J.C., Energy management assistance for small and medium-size manufacturers. A first-stage evaluation of the 1983-1984 EADC program, 9:49970 (R;US)
Energy management assistance for small and medium-size manufacturers. A third-stage evaluation of the 1981-1983 EADC program, 9:49972 (R;US)
Program of direct energy efficiency improvement for medium-size and small manufacturers. Energy Analysis and Diagnostic Centers phase three of the 1981 to 1983 program , 9:50035 (R;US)
Mahaffy, J., *See* Steinke, R., 9:49886
Mahan, H., *See* Sabisky, E., 9:49645
Mahlum, D.D., *See* Pelroy, R.A., 9:50637
Maidorn, C., Solidification and segregations in heavy ingots, 9:50411 (RA;DE;In German)
Maier, K.H., *See* Decman, D.J., 9:50897
Maillie, H.D., Limited life-table factors for estimating radiation-induced cancers over finite time periods, 9:50619 (J;GB)
Maj, A., *See* Decman, D.J., 9:50897
Majer, E.L., *See* Patrick, W.C., 9:49560
Majer, J., Measurement and evaluation system for in-core experiments, 9:49821 (RA;CS;In Czech)
Makara, J., *See* Theilacker, J., 9:50471
Makinodan, Takashi, Delayed immunologic effects of low dose radiation in Japanese A-bomb survivors. Technical progress report, 9:50609 (R;US)
Mako, F.M., Collective ion acceleration by a reflexing electron beam: model and scaling. Memorandum report, 9:50450 (R;US)
Malhotra, S., *See* Cluett, C., 9:49558
Malte, P.C., Oxidation of volatiles in residential wood burning equipment. Final technical report, September 1980-February 1984, 9:49589 (R;US)
Malvezzi, A.M., *See* Campisano, S.U., 9:50221
Mamantov, G., *See* Chapman, D.M., 9:50325
See Smith, G.P., 9:50313
Manca, J., *See* Jory, H.R., 9:51035
Mancini, L., *See* Cave-Bondi, G., 9:50611
Mandzhukov, I., *See* Manushev, B., 9:50578
Mandzhukova, B., *See* Manushev, B., 9:50578
Manes, B., *See* Arendt, F., 9:51034
Manghnani, M.H., Physical characterization of magma. Progress report, 9:50666 (R;US)
Manheimer, W.M., *See* Grossmann, J.M., 9:50451
Mann, C., *See* Hunt, W.F. Jr., 9:50531
Manolova, M., *See* Apostolov, T., 9:49775
Manov, S., Equations with non zero energy momentum tensor for the gravitational field, 9:50958 (RA;BG;In Bulgarian)
Mansur, L.K., *See* Coghlan, W.A., 9:51018
See Horton, L.L., 9:50098
Manthey, C., *See* Sievert, D., 9:49794
Manushev, B., Gamma-spectrometrical measurements in-situ of natural waters in Bulgaria, 9:50578 (RA;BG;In Bulgarian)
Maor, U., Total cross sections for two off shell photons, 9:50777 (R;DE)
Marian, E.J., NASA flight electronics environmental stress screening survey, 9:50423 (R;US)
Marianowski, L.G., Update of the sulfur tolerance of molten carbonate fuel cells, 9:49964 (RA;US)
Marina, L.V., Flow in a channel with fluid bleed through lateral walls, 9:50400 (R;SU;In Russian)
Mark, K., Electric utility solar energy activities: 1983 survey, 9:49604 (R;US)
Markel, K.E., Contaminant control in hot coal derived gas streams: proceedings, 9:49388 (R;US)
Markoja, R., *See* Kuby, W., 9:49585
Markvart, J., *See* Bednarik, K., 9:49823
Marlowe, W.H., Stoker test evaluations using clean pellet fuel, 9:49433 (R;US)
Marner, W.J., Survey of gas-side fouling in industrial heat-transfer equipment. Final report, 9:50052 (R;US)
Maroni, V.A., Spectroscopic studies of transition metal ions in molten alkali metal carboxylates, 9:50331 (J;US)
Marroquin, G., *See* Fee, D.C., 9:49434
Marschall, E., Convection heat transfer in the critical region of fluid mixtures. Progress report, 9:50399 (R;US)
Marsh, G.P., *See* Taylor, K.J., 9:49532
Marshall, W.L., High temperature aqueous solutions and energy considerations - physical chemical studies, 9:50298 (R;US)
Marshalla, R.A., *See* Alsmiller, R.G. Jr., 9:49461
Marston, P.G., Magnet failure workshop, 9:51041 (J;FR)
See Becker, H., 9:51039, 9:51040
Martel, R., *See* Lasaki, G.O., 9:49500
Martin, H.L., *See* Stoughton, R.S., 9:49516
Martin, J.A., *See* Young, G.R., 9:50443
Martin, M., *See* Theilacker, J., 9:50470, 9:50471
Martinis, J.M., *See* Devoret, M.H., 9:50372
Marton, J., *See* Breunlich, W.H., 9:50752
Martyn, H.U., *See* Althoff, M., 9:50763, 9:50764, 9:50765
Marx, S.V., Elastic constants of plastic crystals by Schaefer-Bergmann scattering, 9:50207 (J;US)
Mashburn, K.R., *See* Kenoyer, J.L., 9:50486
Maslenikov, O.R., *See* Johnson, J.J., 9:49902
Mason, B.J., *See* Barth, D.S., 9:50552
Massaro, S.A., Power Reactor Events, March-April 1984. Volume 6, No. 2, 9:49764 (R;US)
Massicot, P., What alternate supply options (besides coal) are proving practical, 9:49600 (RA;US)
Mast, M., *See* Gindele, K., 9:49620
Masuda, S.R., *See* Paciorek, K.L., 9:49506
Mathews, G.J., Dynamic stellar neutron-capture nucleosynthesis: the need for more nuclear data for the s-process, 9:50703 (R;US)
Mathiesen, M., Directional wave spectra from the Frigg Field in the North Sea, 9:50581 (R;NO)
Mathis, C.A., *See* Sargent, T., 9:50595
Matsen, J.M., Fluidization 1980 conference: [summary of workshop discussions], 9:49426 (R;US)
Matsuoka, H., *See* Yamazaki, O., 9:50025
Mattheck, C., *See* Czuck, G., 9:49804
Mattson, R.J., U.S.N.R.C. research on severe accidents and other safety matters, 9:49863 (RA;DE)
Maul, P.R., Assessment of the radiological consequences of releases to groundwater following a core-melt accident at the Sizewell PWR, 9:49848 (R;GB)
Mavrodiev, S., Cross sections and multiplicity of charged particles scattered at high energies, 9:50780 (RA;BG;In Bulgarian)
Maxey, W.A., *See* Kiefner, J.F., 9:49471
May, R.P., *See* Wheeler, K.R., 9:50156
Mayer, G.G., *See* Hendrikson, J.G., 9:49331
Mayer, J.W., *See* Gyuali, J., 9:50233
Mayer, P., *See* Pflueger, H., 9:49798
Maynard, C.W., *See* Badger, B., 9:51033
Maziasz, P.J., Swelling and swelling resistance possibilities of austenitic stainless steels in fusion reactors, 9:50095 (R;US)
See Kenik, E.A., 9:50100
Mazurkiewicz, M., *See* Arens, C., 9:50289
Mazzi, U., *See* Bandoli, G., 9:50354
Mazzocco, N.J., *See* Rogers, S.E., 9:49374
Mazzolini, A.P., Application of an alpha particle microbeam to tissue analysis in medicine, 9:50276 (RA;AU)
See Sealock, R.M., 9:50275
McBay, E.H., *See* Russell, D.H., 9:50338
Mcbreen, J., Rotating disk electrode apparatus for the study of fuel cell reactions at elevated temperatures and pressures, 9:49966 (J;US)
McBryan, O., *See* Chern, I.L., 9:50398
McCabe, T.F., *See* Neal, R.W., 9:49686
McCallum, J.C., Channeling contrast microscopy: application to large grain polycrystalline silicon, 9:50283 (RA;AU)
Mccammon, D., *See* Burrows, D.N., 9:50691

McCann, L.L., *See* Maginn, J.C., 9:49972, 9:50035
McCarville, T.J., Special topics reports for the reference tandem mirror fusion breeder: liquid metal MHD pressure drop effects in the packed bed blanket. Vol. 1, 9:51036 (R;US)
McChesney, H.R., *See* Melikian, G., 9:49906
McClain, F.W., *See* Chan, V.S., 9:50986
McClellan, R.O., *See* Bechtold, W.E., 9:50640
See Mitchell, C.E., 9:50638
See Sun, J.D., 9:50641
McClish, R.F., The Ohio oil shale core study, Shawnee No.1, Scioto County, Ohio, 9:49491 (BA;US)
McCloskey, M.W., *See* Breault, R.D., 9:49962
McCollor, D.P., Combustion research and ash fouling, 9:49428 (RA;US)
McConnell, J.R., *See* York, R.L., 9:50463
McCormick, C.L., Improved polymers for enhanced oil recovery synthesis and rheology. Sixth annual report, October 1982-September 1983, 9:49447 (R;US)
McCown, D.L., *See* Baker, R.M., 9:50567
McCrary, J.H., *See* Won, Y.S., 9:49666
McCusker, C.B.A., Future of cosmic ray physics, 9:50670 (RA;AU)
McDaniel, F.D., *See* Wilson, S.R., 9:50237
McDaniel, O.H., *See* Reethof, G., 9:49756
McDonald, C.W., Study of scale and noncondensables in an evaporator. Annual report, 1 October 1983-30 September 1984, 9:49729 (R;US)
McGowan, J.J., Direct comparison of unloading compliance and potential drop techniques in J-integral testing, 9:50409 (R;US)
McGregor, D.M., *See* Salzman, G.C., 9:50599
McHargue, C.J., Reactivity of ion implanted silicon carbide, 9:50160 (R;US)
Surface mechanical properties and wear behavior of ion implanted TiB_2, 9:50159 (R;US)
See White, C.W., 9:50157
McIntyre, D.A., Solar shading of windows: a simple photographic analysis, 9:49688 (R;GB)
Mckee, W.R., Development and evaluation of the Texas Instruments Solar Energy System, 9:49677 (BA;US)
McKellar, B.H.J., Parity admixtures in the nucleon wavefunction, 9:50906 (RA;AU)
See Gorman, R.M., 9:50807
See Granek, H., 9:50782
McKenzie, C.D., Helium microprobe analysis at Melbourne of semiconductor materials, 9:50282 (RA;AU)
See McCallum, J.C., 9:50283
McLaren, L.H., High-level radioactive wastes. Supplement 1, 9:49548 (R;US)
McLaughlin, S.B., *See* Dale, V.H., 9:50524
McLean, W.J., Direct formation of NO_2 in combustion products, 9:50538 (J;NL)
McLeod, R.J., P_{11} channel and the effects of crossing symmetry, 9:50797 (RA;AU)
McMahon, R.A., *See* Ahmed, H., 9:50242
See Davis, J.R., 9:50241
Mcmahon, T., *See* Sabisky, E., 9:49645
McMillan, G.B., Processing of shallow (Rp<150 /SUP o/ A) implanted layers with electron beams, 9:50238 (BA;NL)
McMullin, P.G., *See* Dutta, S., 9:49609
McNair, M.B., Coal distribution, January-June 1984, 9:49435 (R;US)
McNaughton, D.J., *See* Ruff, R.E., 9:50528
McNeill, K.G., *See* Zubanov, D., 9:50843
Mcnulty, P.J., *See* Rich, F.J., 9:50715
McPhillips, M., Passive solar homes, 9:49702 (B;US)
McStay, J.R., *See* Cluett, C., 9:49558
Meadows, J.W.T., *See* Meyer, R.A., 9:50881
Medeiros, W.H., *See* Novak, K.M., 9:50521
Mei, J.S., *See* Shana, J.Yu., 9:49497
Meier, D.L., *See* Rohatgi, A., 9:49610
Meier, G.H., Hot corrosivity of coal conversion product on high temperature alloys. Final report, 9:50109 (R;US)
Meiss, J.D., *See* Hazeltine, R.D., 9:51005, 9:51006
Meissner, F., Fuel savings by advanced vehicle drive systems, 9:50076 (R;DD;In German)
Melamud, M., *See* Pinto, H., 9:50114
Melikian, G., Assessment of nonlatent heat storage technologies for industrial applications, 9:49906 (R;US)
Melikov, Yu.V., *See* Eremin, N.V., 9:50854, 9:50855
Melzer, H.H., Dissertation on a direct injection Diesel process with automatic control, dependent on load, of the ratio of the fuel adhering to the walls to that distributed in the air, with particular attention to exhaust gas turbo-supercharging and exhaust gas feedback, 9:50082 (R;DE;In German)
Mengelkamp, H.T., *See* Fries, S., 9:49736
Menningen, M., *See* Decman, D.J., 9:50897
Mensing, R.W., *See* Lo, T.Y., 9:49890
Menyuk, N., Signal averaging limitations in heterodyne- and direct-detection laser remote sensing measurements, 9:50518 (BA;NL)
Menzler, P.M., *See* Faubel, W., 9:49519
Merdzan, M., *See* Ulbricht, J., 9:50832
Merli, S., *See* Cave-Bondi, G., 9:50611
Merz, E., Aqueous chemical reprocessing of HTR fuel, 9:49518 (R;DE)
Metz, P.D., *See* Leigh, R.W., 9:49656
Meyder, R., SSYST-3. Input description, 9:49873 (R;DE;In German)
Meyer, F., Experience with regard to safety of installations at the Biblis nuclear power plant, 9:49877 (RA;DE;In German)
Meyer, R.A., Opposing properties of particle-hole and intruder-hole bands in N = 87 nuclei and ^{149}Sm levels populated by ^{149}Pm (β^-) and ^{149}Eu(EC), 9:50881 (J;GB)
Michael, I., *See* Rich, F.J., 9:50715
Michalek, K., *See* Leigh, R.W., 9:49656
Michard, G., Compilation of thermodynamic data on water-mineral equilibria in hydrothermal reservoirs. Final report, 9:49731 (R;LU;In French)
Michel, M., *See* Weres, O, 9:49477
Mientek, A.P., *See* Breault, R.D., 9:49962
Mihaly, G., Pinning of charge density waves by irradiation induced defects in orthorhombic TaS_3, 9:50201 (R;HU)
Mihaly, L., *See* Mihaly, G., 9:50201
Mikhin, V.I., To approximate thermal simulation of fuel rods with power peaking, 9:49815 (R;SU;In Russian)
Mikkelsen, D.R., Optimization of tokamak reactors with beam-driven current, 9:51014 (RA;GB)
Miksch, M., Loadings in horizontal feedwater pipes of LWRs by thermal shock and temperature differences due to thermal layers, 9:49767 (RA;DE;In German)
Milanovich, F., *See* Hirschfeld, T., 9:50575, 9:50580
Mildner, D.F.R., *See* Brun, T.O., 9:49915
Miller, D.P., Process evaluation of the human reliability data bank, 9:49937 (R;US)
Miller, G.N., *See* Hamel, W.R., 9:50495
Miller, H.W., *See* Kerns, Q.A., 9:50425
Miller, J.C., Multiphoton ionization photoelectron spectroscopy: xenon and nitric oxide, 9:50340 (J;NL)
Vacuum ultraviolet photoionization of cold molecular beams, 9:50720 (R;US)
Miller, R.M., What restoration ecology can tell us about mycorrhiza, 9:50549 (R;US)
Miller, S.J., Particulate characterization, 9:49753 (RA;US)
Miller, T., Surface core-level shifts for Ge(100)-(2 x 1), 9:50151 (J;GB)
Mills, A.F., *See* Pesaran, A.A., 9:49700
Mills, R.L., New phases and chemical reactions in solid CO under pressure, 9:50202 (R;US)
Milora, S.L., *See* Houlberg, W.A., 9:51024
Milton, K.A., *See* Reid, J., 9:50788
Minato, Akira, *See* Ito, Kazutoshi, 9:49832
Minh, N.G., The electrochemical behavior of sulfide ions in molten cryolite, 9:50333 (J;US)
Minich, R.W., *See* Hirsch, A.S., 9:50868
Minkov, V., *See* Berry, G.F., 9:50406
Minning, C.P., *See* Duncan, L.B., 9:49649
See Garcia, A. III, 9:49640
Mintzer, O., Remote sensing survey of energy losses from public buildings. Final report, 9:50002 (R;US)
Miracky, R.F., Chaos and related nonlinear noise phenomena in Josephson tunnel junctions, 9:50955 (R;US)
Misawa, M., *See* Brun, T.O., 9:49915
Misek, J., *See* Theilacker, J., 9:50471
Mishev, I., *See* Radicheva, M., 9:49828
Mitchell, C.E., Distribution, retention, and fate of 2-aminoanthracene in rats after inhalation, 9:50638 (J;US)
Mitchell, I.V., Interactions of MeV energy ion beams with solids, 9:50189 (RA;AU)
See Brown, R.A., 9:50284
See Forster, J.S., 9:50892
See Rossiter, K.G., 9:50192
Mitchell, L.W., Alpha particle induced reactions on ^{43}Ca and the mass 45 bottleneck, 9:50858 (RA;AU)
See Sevior, M.E., 9:50864
See Tingwell, C.I.W., 9:50859
See Weber, R.O., 9:50853
Mitchell, M.J., Fine coal cleaning, 9:49422 (RA;US)

Mitchell, R.C. III, Energy conservation and utility marketing strategies: is there a conflict?, 9:50045 (RA;US)
Mitter, H., Factorization theorem for an exponential operator, 9:50971 (R;AT)
Particles in spherical electromagnetic radiation fields, 9:50970 (R;AT)
Representation for spherical harmonics of rotated argument, 9:50972 (R;AT)
Miyazaki, T., *See* Count, B.M., 9:49732
Mizicko, D., *See* Theilacker, J., 9:50471
Moberg, P.O., *See* Liem, H., 9:49398
Mockler, R.C., *See* O'Sullivan, W.J., 9:50317
Moebs, N.N., Geologic factors in coal mine roof stability--a progress report. Information circular/1984, 9:49416 (R;US)
Moeller, P., *See* Leander, G.A., 9:50905
Moenig, W., *See* Sievert, D., 9:49794
Moison, J.M., Laser-induced surface defects, 9:50252 (BA;NL)
Mok, C.Y., Ground- and excited-state electron-transfer reactions: photoinduced redox reactions of poly(pyridine)ruthenium(II) complexes and cobalt(III) cage compounds, 9:50336 (J;US)
Mokler, B.V., *See* Bechtold, W.E., 9:50640
Moltz, D.M., Neutron deficient mass surface between the 1f/sub 7/2/ and 1g/sub 9/2/ shells: the masses of ^{77}Kr and ^{75}Kr, 9:50867 (R;US)
Mon, G.R., Design solutions for the solar cell interconnect fatigue fracture problem, 9:49650 (BA;US)
Monnet, J., Study of polymers and/or copolymers for use in the preparation of separators for the electrolysis of water: technology of the preparation of the separators. Final report, 9:49575 (R;LU;In Italian)
Montan, D.N., *See* Patrick, W.C., 9:49560
Montel-Cohen, T., *See* De Vaul, D., 9:49921
Montgomery, W.D., Transport costs and the spatial distribution of natural gas prices, 9:49479 (R;US)
Montvay, I., Monte Carlo calculation with unquenched Wilson-Fermions, 9:50801 (R;DE)
Moore, B., *See* Emanuel, W.R., 9:50523
Moore, D.F., *See* Turner, T.F., 9:49496
Moore, J.L., Geologic map and mineral resources summary of the Sewanee Quadrangle, Tennessee, 9:49408 (R;US)
Moore, J.R., *See* Nave, S.E., 9:50102
Moore, J.W., Assembly and installation of a pair of superconducting buses for the Large Coil Test Facility, 9:51019 (R;US)
Moore, N., Assessment of advanced technology for industrial cogeneration, 9:49938 (R;US)
See Bluhm, S., 9:49939
Moore, W.E., Overview to DOE/Fossil Energy's gas stream contaminant control program, 9:49336 (RA;US)
Morales, G.J., *See* Decyk, V.K., 9:50992
Moreno, S., *See* Olsen, A.R., 9:50019, 9:50020, 9:50021, 9:50022
Moretto, L.G., New statistical and nonstatistical effects in deep inelastic heavy-ion collision, 9:50919 (J;IT)
Morgan, W.F., Effect of 3-aminobenzamide on the rate of ligation during repair of alkylated DNA in human fibroblasts, 9:50646 (J;US)
Moritani, H., *See* Onodera, S., 9:50116
Morpurgo, M., *See* Marston, P.G., 9:51041
Morris, C.L., Excitation of giant resonances in pion inelastic scattering, 9:50847 (J;FR)
Morris, J.W. Jr., *See* Wu, I.W., 9:50141
Morris, P.T., *See* Bakalyar, D.M., 9:50513
Morris, S.C., *See* Kramer, C.F., 9:50629
Morrison, I., Bose-fermi U(6/2j+1) supersymmetries and high spin anomalies, 9:50903 (R;AU)
See Assafiri, Y.I., 9:50907
See Stuchbery, A.E., 9:50889
Morss, L.R., Enthalpy of formation of americium sesquioxide; systematics of actinide sesquioxide thermochemistry, 9:50297 (R;US)
Moser, H., Institute of Radiohydrometry annual report 1981, 9:50656 (R;DE;In German)
Moss, H.D., Extended Fuel Burnup Demonstration Program. Summary final report, 9:49770 (R;US)
Mozzar, F., *See* Coultis, D., 9:51049
Motley, R., Lower hybrid current drive in the PLT tokamak, 9:50999 (RA;GB)
Moujaes, S.F., Assessment of feedability of Kerr-McGee ash concentrate, 9:49345 (R;US)
Moyer, M.D., *See* Biegelsen, D.K., 9:50226
Muddle, B.C., Interphase boundary precipitation in liquid phase sintered W-Ni-Fe and W-Ni-Cu alloys, 9:50145 (J;US)
Mudge, L.K., *See* Baker, E.G., 9:49587
See Brown, M.D., 9:49586
Muehldorf, V., *See* Donhoffer, D., 9:50291
Mueller, R., Internal safeguards for centrifuge enrichment plants. Concepts and procedures for safeguards and the international Hexapartite Safeguards Project (HSP), 9:49569 (R;DE;In German)
Mueller, V., *See* Sedlacek, J., 9:49820
Mueller, W., *See* Thomas, W., 9:49793
Muenchmeyer, D., *See* Becker, E.W., 9:49511
Muenter, J.S., Infrared excitation of clusters and ions of atmospheric interest. First progress report, September 1, 1983-August 31, 1984, 9:50714 (R;US)
See DeLeon, R.L., 9:50318
Mulholland, J.A., Application of reburning for NO(x) control to a firetube package boiler. Report for April 1983-March 1984, 9:50434 (R;US)
Mulik, P.R., High-temperature removal of alkali vapors in hot-gas cleaning systems, 9:49343 (RA;US)
Muller, R.A., Evidence for a solar companion star, 9:50675 (R;US)
Munz, D., Assessment of cracks in components of nuclear power plants, 9:49813 (RA;DE;In German)
See Czuck, G., 9:49804
Murphy, B.L., *See* Gillings, J.C., 9:49897
Murphy, D.W., *See* Ballou, J.E., 9:50620
Murphy, F.H., Strategic oil stocks and public-private interactions: a dynamic game analysis, 9:49457 (R;US)
Murphy, L.M., Technical and cost potential for lightweight, stretched-membrane heliostat technology, 9:49709 (BA;US)
Murray, W., *See* Gill, P.E., 9:51062
Muschietti, L., *See* Kritz, A.H., 9:50989
Mushotzky, R.F., *See* Ferland, G.J., 9:50694
Muth, L., *See* Frischknecht, F.C., 9:50664
Mutka, H., *See* Mihaly, G., 9:50201
Mutze, U., *See* Castrigiano, D.P.L., 9:50969
Mykles, D.L., Muscle atrophy and restoration during molting, 9:50600 (R;US)
Role of calcium-dependent proteinase in molt-induced claw muscle atrophy, 9:50601 (R;US)
Myles, K.M., *See* Fee, D.C., 9:49434

N

Nacheva-Khristova, V., *See* Karamanova, Zh., 9:50270
Nackord, S., *See* Kuby, W., 9:49585
Nadav, I., *See* Hrehuss, G., 9:50673
Naem, A.A., *See* Calder, I.D., 9:50235
Nagel, K., Modelling of the off-gas-cleaning system of the planned reprocessing plant as a basis for a safety analysis, 9:49520 (RA;DE;In German)
Naguib, H.H., *See* Calder, I.D., 9:50235
Nakach, R., *See* Gell, Y., 9:50994
Nakamura, H., *See* Kajiura, S., 9:51044
Nankov, N., *See* Kolev, N., 9:49799
Nanstad, R.K., *See* McGowan, J.J., 9:50409
Narasimhan, R., *See* Gerrish, H.P., 9:49581
Narayan, J., Flame annealing of ion implanted silicon, 9:50240 (BA;NL)
See Appleton, B.R., 9:50099
See Holland, O.W., 9:50184
See Lucovsky, G., 9:50420
Narnhofer, H., *See* Haag, R., 9:50704
Nasby, R.D., *See* Weaver, H.T., 9:49634
Natesan, K., Oxidation-sulfidation behavior of materials in coal-conversion environments, 9:50152 (J;JP)
Nattrass, H.L., *See* Limebeer, D.J.N., 9:49762
Naumova, N.M., *See* Kadmenskij, A.G., 9:50947
Nave, S.E., Magnetism of californium metal, 9:50102 (R;US)
Nazarenko, N., Polymer thick-film conductors and dielectrics for membrane switches and flexible circuitry, 9:50421 (R;US)
Neal, R.W., Assessment of how residential passive solar systems impact utilities. Final report, 9:49686 (R;US)
Neathery, T.L., *See* Rheams, K.F., 9:49502
Neff, G.W., Evaluation of end-cap-less tensile specimen for explosive testing, 9:50505 (R;US)
Neill, P.H., Dependence of liquefaction behavior on coal characteristics. Part VI. Relationship of liquefaction behavior of a set of high sulfur coals to chemical structural characteristics. Final technical report, March 1981 to February 1984 , 9:49352 (R;US)
Nelson, C.J., *See* Marlowe, W.H., 9:49433

Nelson, P., Computational study of discretization error for the upwind finite-difference approximation to the Spencer-Lewis equation, 9:50932 (J;US)
Nelson, W.D., MFTF-α+T: an upgrade to the MFTF-B, 9:51020 (R;US)
Nemanich, R.J., Aligned, coexisting liquid and solid regions in pulsed and cw laser annealing of Si, 9:50219 (BA;NL)
Nemerow, N.L., *See* Gerrish, H.P., 9:49581
Nemzek, T.A., Operation of the EPRI Nondestructive Evaluation Center. 1983 annual report, 9:49933 (R;US)
Nesbitt, D.M., *See* Alsmiller, R.G. Jr., 9:49461
Neumaier, F., *See* Moser, H., 9:50656
Nevitt, M.V., Phonon properties of $LaNbO_4$ deduced from heat-capacity measurements, 9:50185 (R;US)
Newman, D.F., Dry storage of LWR spent fuel in the US: a status report, 9:49523 (R;US)
Newman, J.A., *See* Sienko, M.J., 9:50182
Newton, A., *See* Weres, O, 9:49477
Newton, J.O., Heavy-ion physics - the future, 9:50872 (RA;AU)
See Chatterjee, A., 9:50883
Neyer, B.T., *See* Chang, J., 9:50501
Nguen Mong Zao, Gauge invariance and selection rules for elementary particles, 9:50794 (RA;BG;In Russian)
Nicholson, W.L., Role of environments in managing data analysis, 9:51059 (R;US)
See Carr, D.B., 9:51060
Nickel, H., *See* Arens, C., 9:50289
Nidetz, J., *See* Erlbaum, N.S., 9:50031
Niel, M., *See* Pizzichini, G., 9:50713
Nielsen, C.E., Salt-gradient solar pond development. Final report, September 1, 1982-February 29, 1984, 9:49707 (R;US)
Niemi, A.J., Spectral asymmetry on an open space, 9:50810 (J;US)
Nieto, M.M., What are squeezed states really like, 9:50968 (R;US)
Nikkelsen, D.R., Neutral beam current drive in TFTR, 9:51017 (RA;GB)
Nikolova, E., *See* Karamanova, Zh., 9:50270
Nilsen, J., *See* Agerstrand, T., 9:49967
Nilsson, L.I.O., *See* Kenney, S.M., 9:49401
Nilsson, S., *See* Delhen, R., 9:49920
Nishi, M.F., *See* Luton, J.N., 9:51029
Nissim, Y.I., *See* Sapriel, J., 9:50218
Nitz, K.C., *See* Ruff, R.E., 9:50528
Nix, J.R., *See* Leander, G.A., 9:50905
Noack, H., Measurement and calculation of the three-dimensional instationary temperature field in underwater welded plates, 9:50112 (R;DE;In German)
Nochumson, D.H., Copper smelters and atmospheric visibility in the southwest, seasonal analysis, 9:50534 (J;US)
Noda, E.K., *See* Bienfang, P.K., 9:50565
Nogar, N.S., *See* Fasano, D.M., 9:50342
Nomofilov, E.V., *See* Marina, L.V., 9:50400
Norland, D.L., Impact and cost-effectiveness of utility conservation programs: the Hartford Foundation project, 9:49992 (RA;US)
Norman, P., *See* Wright, S., 9:50046
Notestein, J.E., *See* Shana, J.Yu., 9:49497
Noufi, R., Electronic properties versus composition of thin films of $CuInSe_2$, 9:49629 (J;US)
Novak, K.M., Health and Environmental Risk Analysis Program workshop: potential public health impacts of airborne organic combustion products, 9:50521 (R;US)
Novick, R., *See* Hughes, J.P., 9:50699
Novozhilov, V.N., *See* Vasil'ev, V.K., 9:50126
Nuckovich, M., Three phase AC motor controller, 9:50426 (P;US)
Nurzynski, J., *See* Kondo, Y., 9:50852
Nyholm, R.A., *See* Patrick, W.C., 9:49560
Nyilas, G., *See* Arendt, F., 9:51034

O

O'Brien, J.J., *See* Breault, R.D., 9:49962
O'Brien, K., The contribution of cosmogenic radioisotopes to solar neutrino flux measurements, 9:50709 (J;US)
O'Brien, P.M., Elemental microanalysis of individual blood cells, 9:50277 (RA;AU)
O'Connor, D.J., Surface structure analysis with LEIS, 9:50194 (RA;AU)
O'Donnell, F.R., *See* Travis, C.C., 9:50636
O'Keefe, G.J., $^{48}Ca(\gamma,n+p)$ photonuclear cross section in the giant dipole resonance region, 9:50861 (RA;AU)
O'Keefe, J.C., Measuring the impact of residential conservation programs: a case study, 9:49984 (RA;US)
O'Kelly, G.D., *See* Kocher, D.C., 9:49540
O'Neal, D.L., *See* Zehr, F.J., 9:49698
O'Rourke, R., *See* Lippert, T.E., 9:49389
O'Sullivan, W.J., Light scattering studies of lower dimensional colloidal particle and critical fluid systems, 9:50317 (R;US)
Oakes, L.C., *See* Anderson, J.L., 9:49817
Obrusnik, I., Trace element determination in biological materials by neutron activation analysis, 9:50268 (RA;CS;In Czech)
Odekirk, J.R., *See* Smit, F.J., 9:49383
Oen, C., *See* Gove, N.B., 9:49405
Oerter, H., *See* Moser, H., 9:50656
Ofstad, E.B., Kinetics - studies I. Model experiments with dehydrogenation of propane and isomerization of pentane, 9:50319 (R;NO;In Norwegian)
Ogaza, S., *See* Byrne, A.P., 9:50900
Ogden, P., *See* Lovell, M.A., 9:49551
Ogievetskij, V., Geometry of supergravitation, 9:50957 (RA;BG;In Bulgarian)
Ogle, J.C., *See* Yoo, M.H., 9:50103
Ogrady, W.E., *See* Mcbreen, J., 9:49966
Ohlrogge, K., *See* Koske, P.H., 9:49508, 9:49513, 9:49514, 9:49525
Ohnishi, S., Interface magnetism in metals: Ag/Fe(001), 9:50142 (J;US)
Okamoto, M.P., *See* Bienfang, P.K., 9:50565
Okamoto, P.R., *See* Lam, N.Q., 9:50101
See Rehn, L.E., 9:50105
Okano, K., Current drive by ICRF heating of alpha-particles and beam ions, 9:50984 (RA;GB)
Olausson, L., Effects of solid fuel fired plants for district heating. Air quality studies in two towns, 9:49406 (R;SE;In Swedish)
Olinger, B.W., *See* Mills, R.L., 9:50202
Olive, K.A., *See* Schramm, D.N., 9:50710
Oliver, H.W., Concept for operations in a nuclear environment. Technical report, 9:50509 (R;US)
Oliver, T., Hood River Conservation Project, 9:49989 (RA;US)
Olsen, A.R., Weather data for simplified energy calculation methods. Volume I. Eastern United States: TRY data, 9:50019 (R;US)
Weather data for simplified energy calculation methods. Volume II. Middle United States: TRY data, 9:50020 (R;US)
Weather data for simplified energy calculation methods. Volume III. Western United States: TRY data, 9:50021 (R;US)
Weather data for simplified energy calculation methods. Volume IV. United States: WYEC data, 9:50022 (R;US)
Olson, D.L., Cerenkov detector for heavy-ion velocity measurements, 9:50482 (R;US)
Olson, E.S., Organic structure, 9:49379 (RA;US)
See Dollimore, J., 9:49334
Olson, G.L., Laser-induced solid phase crystallization in amorphous silicon films, 9:50244 (BA;NL)
Olszewski, M., Advanced latent heat storage media for high-temperature industrial applications, 9:49907 (R;US)
Composite latent/sensible energy storage media for high-temperature industrial applications, 9:49905 (R;US)
Oma, K.H., Off-gas treatment and characterization for a radioactive in situ vitrification test, 9:49556 (R;US)
Onodera, S., Manufacturing of ultra-large diameter 20 MnMoNi 5 5 steel forgings for reactor pressure vessels and their properties, 9:50116 (RA;DE)
Opalev, O.A., *See* Rozhkov, V.V., 9:50738
Ophel, T.R., *See* Drumm, P.V., 9:50839
See Fifield, L.K., 9:50851
See Hotchkiss, M.A.C., 9:50860
See Kondo, Y., 9:50852
Orens, J.H., *See* Brecht, S.H., 9:50511
ORiordan, T., *See* Dooley, J.E., 9:49935
Orlowski, M., Pauli-corrected Breit-Wigner formulae for compounds resonances in two- and three-cluster systems, 9:50922 (J;IT)
Ornellas, D., *See* Costantino, M., 9:50506
Orr, D., *See* Rassool, R.P., 9:50875
Orr, D.A., *See* Rassool, R.P., 9:50877
Osantowski, R.A., *See* Dempsey, C.R., 9:50572
Osburn, T., Texas utilities' rebate program, 9:50043 (RA;US)
Ostenson, J.E., *See* Sue, J.J., 9:50386
Osullivan, D., High-resolution study of ultra-heavy cosmic-ray nuclei (A0178), 9:50676 (R;IE)
Otto, G., *See* Gajst, F., 9:50198
Otvos, J.W., Polyelectrolytes as interfaces for retarding back-reaction in photoinduced electron transfer, 9:50335 (R;US)
Oudar, J.L., *See* Sapriel, J., 9:50218

Ovcharov, A.M., Automatic system of scientific investigations for nuclear analysis, 9:51053 (RA;SU;In Russian)
Ovcharova, Zh., *See* Velkov, K., 9:49776
Oven, M.J., *See* McLean, W.J., 9:50538
Ovsetsina, A.Eh., *See* Pavlov, P.V., 9:50128
Owens, T.C., *See* Rindt, J.R., 9:49333
Oxley, J.H., *See* Kenney, S.M., 9:49401

P

Paciorek, K.L., The reactivity of pyrite in raw eastern oil shale and its transformation during processing, 9:49506 (BA;US)
Paddock, R.A., *See* Baker, R.M., 9:50567
Paesler, M.A., *See* Germain, P.J., 9:50245
Painter, L.R., Vacuum ultraviolet electronic properties of liquids. Annual progress report, February 1, 1984-January 31, 1985, 9:50927 (R;US)
Palmer, P., *See* Christensen, D., 9:50437
Palmstrom, C.J., *See* Gyuali, J., 9:50233
Pantages, G., *See* Lao, V.U.S., 9:49582
Papadimitriou, P., HTCC - a heat transfer model for gas-steam mixtures, 9:49846 (R;DE;In German)
Pappas, R.A., *See* Hutton, P.H., 9:49808
Parks, H.G., *See* Liu, Y.S., 9:50234
See Possin, G.E., 9:50227
Parnell, T.A., *See* Benton, E.V., 9:50679
Paschen, H., *See* Dooley, J.E., 9:49935
Passman, S.L., Three-dimensional model for a porous elastic anisotropic solid with inclusions, taking into account dissipation, heat flux, radiation and thermal stress, 9:51061 (R;US)
Patek, P., Considerations on the dimensioning of decay tanks for liquid radioactive wastes. Basic methods and examples, 9:49553 (R;AT;In German)
Design and operational experience with the off-gas cleaning system of the Seibersdorf incinerator plant, 9:49552 (R;AT)
Patrick, W.C., Spent fuel test - Climax: technical measurements. Interim report, Fiscal Year 1983, 9:49560 (R;US)
Patterson, L.K., *See* Subramanian, R., 9:50341
Patterson, R., *See* Jain, R., 9:49392
Paull, M.K., Annual outlook for US coal, 1984: with projections to 1995, 9:49436 (R;US)
Paulson, W.M., *See* Wilson, S.R., 9:50237
Pavlik, N.M., *See* Sefko, J., 9:50385
Pavlov, P.V., Structural transformations in nickel films bombarded by phosphorus and neon ions, 9:50128 (RA;SU;In Russian)
Pawlek, P., *See* Breunlich, W.H., 9:50752
Paxson, V., Portable, public domain LEX for the Software Tools, 9:51056 (R;US)
Payne, M.G., *See* Ferrell, W.R., 9:50754
See Iturbe, J., 9:50339
Peach, H.G., *See* Oliver, T., 9:49989
Peach, J.D., Information on repayment of the government's uranium enrichment program costs and audits of that program's financial statements, 9:49524 (R;US)
Pearce, B.C., Unitarity and K-matrix model fitting, 9:50909 (RA;AU)
Pecinka, L., Diagnostics of nuclear power plant components. Proceedings of a national seminar, 9:49812 (R;CS)
Peck, S.P., *See* Hagen, S., 9:49880
Pedersen, D.R., *See* Gabor, J.D., 9:49851
Pedersen, J.C., *See* Toohey, R.E., 9:50556
Peebles, H.C., *See* Russo, A.J., 9:50139
Peehs, M., *See* Alsmeyer, H., 9:49868
Peirce, J.J., Zigzag configurations and air classifier performance, 9:50430 (J;US)
Peise, G., *See* Althoff, M., 9:50763
Pell, E.J., *See* Sinn, J.P., 9:50639
Pelroy, R.A., Mutagenicity and carcinogenicity of polycyclic aromatic enriched fractions from coal liquefaction materials, 9:50637 (R;US)
Peltola, S.S., Dynamic model for thermochemical heat storage with application to solar heating, 9:49720 (R;FI)
Peneva, Ts., *See* Rajchev, Kh., 9:50413
Peng, T.H., Impacts of bioturbation on the age difference between benthic and planktonic foraminifera in deep sea sediments, 9:50655 (R;US)
Peng, Y.K.M., Advanced performance fusion engineering device based on low safety factor and current drive (FED-A), 9:51022 (R;US)
Pennycook, S.J., Comments on the image contrast from inelastically scattered electrons, 9:50724 (R;US)
Perez-Rodriquez, J., *See* Mintzer, O., 9:50002
Perhac, R.M., Comments on acid rain, 9:50537 (BA;US)
Perinic, D., *See* Alsmeyer, H., 9:49868
Perkins, G.S., *See* Kuban, D.P., 9:49515
Perkins, L.J., *See* Badger, B., 9:51033
Perlack, R.D., Allocation and apportionment of joint-use cost to power: a report on the assessment of headwater benefits charges, 9:49599 (R;US)
Perrin, R.E., High-precision isotopic analysis of nanogram quantities of plutonium, 9:50290 (R;US)
Perry, H., How rapidly can production and use of eastern coal be expanded, 9:49411 (RA;US)
Pervushin, V., *See* Ilieva, N., 9:50804
Pesaran, A.A., Modeling of solid-side mass transfer in desiccant particle beds, 9:49700 (BA;US)
Peters, D., *See* Oliver, T., 9:49989
Petersen, G., *See* Fries, S., 9:49736
Petersen, K., Safety conception of the high temperature reactor with natural heat removal decay in the case of accidents, 9:49860 (R;DE;In German)
Peterson, M.E., *See* Blair, H.T., 9:49555
Peterson, R.R., Wet wall cavity response in ICF reactors, 9:51032 (R;US)
See Badger, B., 9:51033
Peterson, T.J., Fermilab's satellite refrigerator expansion engines, 9:50469 (BA;US)
Petillo, J.T., Structuring energy conservation for results, 9:50044 (RA;US)
Petkov, P., *See* Apostolov, T., 9:49775
Petrick, M., *See* Berry, G.F., 9:50406
Petrie, G.M., Consideration of future climatic changes in three geologic settings, 9:49554 (R;US)
Petrosian, V., Hard X-ray and microwave morphology, 9:50692 (R;US)
Petrovic, C., *See* Chapman, D.M., 9:50325
Petrovic, J.J., *See* Hurley, G.F., 9:50174
Petukhov, V.A., *See* Derkacheva, L.D., 9:50344
Pfluegar, H., Method for convergence acceleration of iterative solutions of eigenvalue-problems in reactor theory and implementation in the DIFGEN-code, 9:49798 (R;DE;In German)
Pflug, A., *See* Grosse, H., 9:50750
Phariss, G.L., *See* Nemzek, T.A., 9:49933
Phillips, J.E., Stability of thin-film Cu2S-based solar cells at Voc under continuous illumination, 9:49639 (BA;US)
Pichlmayer, F., *See* Irlweck, K., 9:50541
Picraux, S.T., *See* Knapp, J.A., 9:50228
Piehl, K.H., *See* Forch, K., 9:50119
Pielorz, J., *See* Berger, C., 9:50767
Piepel, G.F., Models for mixture experiments when the response depends on the total amount, 9:50359 (R;US)
Pietschmann, H., Semi-phenomenological approach to beauty-decay, 9:50787 (R;AT)
Pike, C.D., *See* Vanecek, D.L., 9:50209
Pimpl, M., *See* Schuettelkopf, H., 9:49870
Pinto, H., Neutron diffraction study of the tetragonal $NpCu_4Al_8$ and $ErFe_4Al_8$ intermetallic compounds, 9:50114 (RA;IL)
Pirrmann, R.A., *See* Lippert, T.E., 9:49389
Pissarenko, N.F., Observations of He+ ions in the solar wind, 9:50683 (R;SE)
Pitts, J.H., Performance of the Cascade inertial-confinement-fusion conceptual reactor, 9:51037 (R;US)
Pitzer, K.S., Thermodynamic properties of aqueous NaCl from 273 to 823 K with estimates for higher temperatures, 9:50301 (R;US)
Pizzichini, G., N49: the site of a gamma-ray burst. Preliminary results from X-ray observations, 9:50713 (BA;NL)
Plakman, J.C., Fast reactor programme. Annual progress report 1982, 9:49783 (R;NL)
Plashchinskij, G.I., Investigation of intermediate mass ion implantation in bismuth, 9:50123 (RA;SU;In Russian)
Platonov, N.S., *See* Derkacheva, L.D., 9:50344
Plohr, B., *See* Chern, I.L., 9:50398
Plueddeman, E.P., *See* Coulter, D.R., 9:49619
Plute, K.E., *See* Badger, B., 9:51033
Poate, J.M., Amorphous Si, crystallization and melting, 9:50220 (BA;NL)
See Clark, G.J., 9:50153
Poenitz, W.P., Status of nuclear data of importance for LMFBR applications prior to the evaluation of ENDF/B-VI, 9:49782 (R;US)
Pogany, A.P., *See* Rossiter, K.G., 9:50192
See Short, K.T., 9:50191
Pogany, L., *See* Hrehuss, G., 9:50673
Pohl, B.A., *See* Hansen, L.F., 9:50465
Pohlmann, M., *See* Sievert, D., 9:49794
Poker, D.B., *See* Appleton, B.R., 9:50099
Pokhil, G.P., Data processing with small statistics by Fourier analysis, 9:51054 (RA;SU;In Russian)
Polatti, A.R., *See* Davies, R.F., 9:50899
Pollock, E.O., *See* Logee, T.L., 9:49692

Polyakova, G.N., *See* Rozhkov, V.V., 9:50738
Polyzou, W.N., Scattering and cluster properties in relativistic models of directly interacting confined quarks, 9:50792 (BA;NL)
Ponder, T.C., *See* Wunderle, J.A., 9:50433
Pooler, R.S., Conservation: a regulator's view, 9:50040 (RA;US)
Porile, N.T., *See* Hirsch, A.S., 9:50868
Porkolab, M., *See* Englade, R.C., 9:50991
See Lloyd, B., 9:50997
Porritt, R.E.J., *See* Fardy, J.J., 9:50273
Possin, G.E., The effects of selectively absorbing dielectric layers and beam shaping on recrystallization and FET characteristics in laser recrystallized silicon on amorphous substrates, 9:50227 (BA;NL)
See Liu, Y.S., 9:50234
Post, R.E., Evolution of the mirror approach to fusion: some conjectures, 9:51038 (R;US)
Postma, H., Emerging role of the national laboratory in the development and transfer of materials technology, 9:50089 (R;US)
Potas, T.A., *See* Baker, G.G., 9:49421
Pottinger, J.S., *See* Chamberlain, H.E., 9:50363
Potts, J.D., *See* Chillingworth, R.S., 9:49372
See Hamshar, J.A., 9:49356
Potzel, W., *See* Pinto, H., 9:50114
Powell, P., *See* Verville, G., 9:49911
Powell, P.C., *See* McPhillips, M., 9:49702
Prakash, M., *See* Rowley, N., 9:50923
Prange, A., Development of an analytical procedure for the determination of traces of dissolved heavy metals in seawater by means of total reflection X-ray fluorescence analysis, 9:50266 (R;DE;In German)
Prechtl, H., Energy characteristics of road vehicles represented by the example of an electric transporter, 9:50085 (R;DE;In German)
Preikschat, H., Relations between material properties and performance of wear resistant materials, 9:50161 (R;DE;In German)
Prestidge, J.R., *See* De Vaul, D., 9:49921
Preston, R.J., Use of cytogenetic endpoints in human lymphocytes as indicators of exposure to genotoxicants, 9:50630 (R;US)
Příbac, F., *See* Burnett, M., 9:50874
Priesmeyer, H.G., Sequential Analyse of the data of a monitor for radioactive radiation, 9:50477 (R;DE;In German)
Prifrel, J., Northern States Power Company Appliance Rebate Program, 9:50050 (RA;US)
Prodanov, D., *See* Shekherov, L., 9:50558
Prodanov, J., *See* Shekherov, L., 9:50559
Prodanov, N., *See* Radicheva, M., 9:49829
Prodanov, Ya., *See* Radicheva, M., 9:49830
Prodanova, R., *See* Apostolov, T., 9:49775
Prokop, K., Requirements for diagnostic measurement in pressurized water reactor nuclear power plants, 9:49822 (RA;CS;In Czech)
Spectral analyzer of vibroacoustic signals, 9:49818 (RA;CS;In Czech)
Vibroacoustic diagnostic system, 9:50412 (RA;CS;In Czech)
Proksch, E., Department of Chemistry of the Austrian Research Centre Seibersdorf, 9:50257 (R;AT;In German)
Provance, J., Particle size effects on viscosity of silver pastes: a manufacturer's view, 9:49617 (R;US)
Pruett, D.P., Hot Fuel Examination Facility's neutron radiography reactor, 9:50366 (R;US)
Pullen, J.R., Catalytic coal gasification, 9:49359 (R;GB)
Puzanov, A.A., *See* Bagaev, V.N., 9:50742
See Burenkov, A.F., 9:50124
Pywell, R.E., *See* Zubanov, D., 9:50843

Q

Quayle, S.F., *See* Wooton, R.O., 9:49894
Quigg, C., SSC parameters: what physics demands, 9:50445 (R;US)
Quinn, H.R., *See* Gupta, S., 9:50708
Qureshi, M.H., *See* Hussain, S.D., 9:50668

R

Rachlin, J.N., *See* Fels, M.F., 9:49991
Radeka, V., *See* Fischer, J., 9:50489
Radicheva, M., Quantitative characteristics of the radiation background components in the Vitosha Mountain area and around nuclear reactor IRT-2000, Sofia, 9:49829 (RA;BG;In Bulgarian)
Results and conclusions from the radiation monitoring around the IRT-2000 nuclear reactor in Sofia for the 1962-1982 period, 9:49828 (RA;BG;In Bulgarian)
Results and quantitative evaluations of the radionuclides and the level of the radiation background in Vitosha Mountain area and around the nuclear reactor IRT-2000, Sofia, 9:49830 (RA;BG;In Bulgarian)
See Gelev, M., 9:49831
Radun, A.V., Particle charging in a turbulent air stream, 9:49758 (R;US)
Rae, J., Programme of research into the management and storage of radioactive waste. Mathematical modelling. Annual report 1983, 9:49529 (R;GB)
Raghavan, R., *See* Ahluwalia, K.S., 9:49675
Rahman, A., *See* Saboungi, M.L., 9:50312
Rai-Choudhury, P., *See* Rohatgi, A., 9:49610, 9:49635
Railio, J., Methods for measuring the airtightness and air change rates in buildings, 9:50023 (R;FI;In Finnish)
Raith, K., *See* Schoenauer, W., 9:50403
Raizman, A., NMR study of hydrogen in cathodically charged inconel 718, 9:50113 (RA;IL)
Rajchev, Kh., Radioisotopic methods in metal founding, 9:50413 (RA;BG;In Bulgarian)
Rajeshwar, K., *See* Inguva, R., 9:49501
Rakes, S.L., Brief review of planned R and D (research and development) in the LIMB (Limestone Injection Multistage Burner) development program, 9:50432 (R;US)
Ralston, C.W., *See* Richter, D.D., 9:50545
Raman, S., *See* Rosseel, T.M., 9:50149
Ramaty, R., Nuclear processes in the jets of SS433, 9:50693 (R;US)
Ramm, C.A., Comparison of various observations of M*sub($\mu\pi$) (0.429), 9:50783 (RA;AU)
Ramond, P., Fermions in the desert, 9:50815 (BA;US)
Ramsdell, J.V., MESOI, an interactive atmospheric dispersion model for emergency response applications, 9:50542 (R;US)
Ranade, M.B., *See* Kashdan, E.R., 9:50533
Randerson, D., Atmospheric science and power production, 9:50527 (R;US)
Rao, T.K., Structural basis for mutagenic activity of N-nitrosamines in the Salmonella histidine reversion assay, 9:50645 (BA;US)
Rao, V.U.S., Metal-zeolite catalysts for the conversion of synthesis gas to selected hydrocarbon products, 9:49582 (BA;US)
Rao, Y.V., *See* Rich, F.J., 9:50715
Rasmussen, P., Test of windmill control unit from Skjern Elektro Aps and Styrdata, 9:49740 (R;DK;In Danish)
Test report for VESTAS windmill, type 15, 55 kW. Standard measurements, 9:49738 (R;DK;In Danish)
Test report for Kramsbjerg windmill 14 kW. Standard measurements, 9:49739 (R;DK;In Danish)
Rassool, R.P., Photoneutron cross sections of ^{121}Sb, ^{123}Sb and sup(nat) Sb, 9:50877 (R;AU)
Photoneutron reaction cross sections of ^{121}Sb, ^{123}Sb and Nat.Sb, 9:50875 (RA;AU)
Raudenbush, M.H., Pioneering repository development at the Waste Isolation Pilot Plant, 9:49562 (J;GB)
Rauert, W., *See* Moser, H., 9:50656
Raupach, F., *See* Berger, C., 9:50767
Ray, A.K., *See* Nelson, P., 9:50932
Raymond, M.G., Solar energy system case study: Telex Communications, Blue Earth, Minnesota, 9:49691 (R;US)
See Logee, T.L., 9:49692
Rebel, H., *See* Srivastava, D.K., 9:50865
Rector, N.L., *See* Patrick, W.C., 9:49560
Reed, A.W., Coolability of UO_2 debris beds in pressurized water pools: DCC-1 and DCC-2 experiment results. Revision, 9:49899 (R;US)
Reedy, R.E., *See* Burgener, M.L., 9:50248
Reese, E., *See* Bellinghausen, B., 9:50828
Reethof, G., Some recent progress in acoustic agglomeration of power plant fly ash, 9:49756 (RA;US)
Reeves, G., Don't pay for insulation: buy conservation, 9:49985 (RA;US)
Rehm, K.E., *See* Thomas, G.E., 9:50460
Rehm, W., *See* Jahn, W., 9:49861
Rehn, L.E., Fundamental aspects on ion-beam surface modification: defect production and migration processes, 9:50105 (R;US)
Reichel, S., Influence of particles in diesel engine exhaust gas during cooling and mixing with the surrounding air, 9:50080 (R;DE;In German)
Reichelt, K., *See* Forster, J.S., 9:50892
Reichelt, T., *See* Bellinghausen, B., 9:50828

Reichert, J.D., Analytical optical power concentration calculations for reflection for spherical mirrors, 9:49713 (BA;US)
Reid, D.W., Portable radiography using linear accelerators, 9:49572 (R;US)
Reid, J., Limits on tau composite structure from polarized Z^0 decay, 9:50788 (J;US)
Reid, R.L., Impact of maximum TF magnetic field on performance and cost of an advanced physics tokamak, 9:51025 (R;US)
Reider, J.P., EADS (Environmental Assessment Data Systems) Liquid Effluents Data System, 1982. Annual report, 9:50571 (R;US)
Reineke, H.H., Benefit effort relation of sacrificial layers, 9:49845 (R;DE;In German)
Reinfried, D., Performance analysis of VVER-type fuel rods with the STOFFEL-1 computer code, 9:49778 (R;DD)
Reisfeld, R., Luminescent solar concentrators for energy conversion, 9:49714 (BA;DE)
Reiss, D.B., Nonstandard fermion mass matrices and nucleon decay, 9:50789 (J;US)
Renard, F.M., 1sup(+-+) resonances in $\gamma\gamma$ collisions, 9:50790 (J;IT)
Reuters, H., Joint US-German evaluation of electronic safeguards seal systems, 9:49570 (R;DE)
Rey, N.A.C., *See* Brown, P.A., 9:50658
Rezniczek, A., *See* Mueller, R., 9:49569
Rheams, K.F., Physiochemical characterization of the Devonian Chattanooga Shale in North Alabama and South-Central Tennessee, 9:49502 (BA;US)
Rhee, K.H., *See* Rao, V.U.S., 9:49582
Rhyne, W.R., Methodology for comparing the health effects of electricity generation from uranium and coal fuels, 9:49440 (R;US)
Rich, F.J., Trapped-proton energy spectrum determination (M0002-1), 9:50715 (R;US)
Rich, J.W., CO_2 gamma 3 fundamental band 4.5 micrometers laser potential. Final report 2 May 1983-26 March 1984, 9:50393 (R;US)
Richards, J.R., Department-wide review of advance financing by letter of credit, 9:51046 (R;US)
Richards, W.J., *See* Pruett, D.P., 9:50366
Richardson, G.P., *See* Sterman, J.D., 9:49444
Richardson, M.G., Report to SOTEAG (Shetland Oil Terminal Environmental Advisory Group) on numbers of Tysties ('Cepphus grylle') in the area of the Yell Sound Islands, September 1982, 9:49463 (R;GB)
Richter, B., *See* Reuters, H., 9:49570
Richter, D.D., Effects of prescribed fire on water quality at the Santee Experimental Watersheds in South Carolina, 9:50545 (R;US)
Richter, R., *See* Mcbreen, J., 9:49966
Riciter, B., *See* Mueller, R., 9:49569
Rickert, S.E., *See* Litt, M.H., 9:50176
Rihel, R.K., *See* Hodge, G.A., 9:50467
Rimini, E., *See* Campisano, S.U., 9:50221
Rimkus, J., *See* Althoff, M., 9:50763, 9:50764, 9:50765
Rimpela, R.J.G., Military adaptation of commercial items (MACI) laboratory evaluation of the Code E-430 engine. Final report, 9:50067 (R;US)
Military adaptation of commercial items: laboratory evaluation of the Code E-436 engine. Technical report 17 January-28 July 1983, 9:50068 (R;US)
Rinard, G., Performance of an electrostatic precipitator at simulated PFBC conditions, 9:49755 (RA;US)
Rindt, J.R., Low-rank coal liquefaction, 9:49333 (RA;US)
Rinehart, B.N., DOE Small-Scale Hydropower Program annual status report 1984, 9:49592 (R;US)
Rininsland, H., Status of the reactor safety research in the Project Nuclear Safety, 9:49864 (RA;DE;In German)
See Bork, G., 9:49878
Rippel, W., *See* Krauthamer, S., 9:49654
Ritschard, R., *See* Goldman, C., 9:49996
Rivier, M., Visualization of temperature profiles in a-Si crystallized in the explosive made by CW laser, 9:50246 (BA;NL)
Rizzo, T.G., *See* Reid, J., 9:50788
Roach, F., *See* Ford, A., 9:49757
Roberto, J.B., *See* Behrisch, R., 9:51026
See Roth, J., 9:50718
Roberts, F.P., *See* Byers, K.R., 9:49571
Roberts, Th.G., *See* Holl, H.B., 9:50396
Robertson, D.K., Southwest thermal mass study, Tesuque Pueblo, New Mexico. Observation and prediction of the heating season thermal mass effect for eight test buildings with and without windows. Research Phase II, January 1983-June 1983, 9:49687 (R;US)
See Gustinis, J., 9:50005
Robinson, I.M., How will high energy costs affect social forms and patterns: relationships between energy-conservation, transportation, and spatial structures, 9:49922 (RA;US)
Robinson, McD., *See* Celler, H.K., 9:50229
Robl, T.L., The geology and geochemistry of Devonian Shales in South and West Central Kentucky, 9:49492 (BA;US)
See Bland, A.E., 9:49494
Robson, B.A., *See* Kondo, Y., 9:50849, 9:50850, 9:50852
Roche, C.T., *See* Strauss, M.G., 9:50488
Rochelle, R.W., *See* Birdwell, J.D., 9:50378, 9:50380
Rockwell, D.A., *See* Lam, J.F., 9:50392
Rode, C.H., *See* Theilacker, J., 9:50470
Rodenburg, R., *See* Wong, S., 9:50394
Rodot, M., *See* Bouree, J.E., 9:50250
Roeckl, E., Properties of heavy-ion produced nuclei far from stability, 9:50870 (R;DE)
Roemgens, J., Analytical model for an input/output-subsystem, 9:51055 (R;DE;In German)
Rofer-DePoorter, C.K., Untangling the water gas shift from Fischer-Tropsch: A Gordian knot?, 9:49577 (BA;US)
Rogers, C.B., *See* Gerwin, H.J., 9:49717
Rogers, J.D., *See* Boenig, H.J., 9:49903
Rogers, S.E., Coal liquefaction in a synthoil reactor without added catalyst, 9:49374 (J;US)
Rogo, M., *See* Cave-Bondi, G., 9:50611
Rohatgi, A., Development of high-efficiency solar cells on silicon web. First quarterly progress report, April 20-July 15, 1984, 9:49610 (R;US)
Impurities in polycrystalline silicon solar cells, 9:49635 (BA;US)
Rohleder, H., *See* Voigt, K., 9:50635
Roll, J.B., Home energy rating system, 9:49987 (RA;US)
Romanov, I.G., *See* Pavlov, P.V., 9:50128
Roos, E., Application and evaluation of post-yield fracture mechanics concepts for cracked vessels, 9:49809 (RA;DE;In German)
See Zimmermann, C., 9:50121
Roots, R., *See* Tobias, C.A., 9:50627
Ropertz, G., *See* Breidung, P., 9:49367
Roschke, E.J., Wind loading on solar concentrators: some general considerations, 9:49663 (R;US)
Rose, A.B., *See* Greene, D.L., 9:50032
Roseberry, L.M., *See* Shults, W.D., 9:50261
Rosen, M.D., Evidence of a laser intensity threshold for the onset of inhibited electron transport, 9:51011 (J;GB)
Rosenberg, H.S., *See* Kenney, S.M., 9:49401
Rosenberg, L., Cogeneration computer model assessment: advanced cogeneration research study, 9:49940 (R;US)
See Bluhm, S., 9:49939
Rosenow, M.K., Properties of liposomes containing 212Pb, 9:50597 (J;GB)
Rosenthal, M.W., *See* Schubert, J., 9:50633
Rosenwinkel, E., *See* Miller, T., 9:50151
Ross, M., Using television cameras to measure emittance, 9:50453 (R;US)
Ross, R.G. Jr., *See* Mon, G.R., 9:49650
Rosseel, T.M., Application of heavy-ion-induced x-ray satellite emission to alloys, 9:50149 (J;GB)
Rossiter, K.G., Measurements of disorder distributions in GaAs using He^+ ion channeling, 9:50192 (RA;AU)
Rosskamp, P., *See* Althoff, M., 9:50763, 9:50764, 9:50765
Rotella, F.J., *See* Brun, T.O., 9:49915
Roth, R.L., Operation wrap-up/seal-up; an inside look, 9:49990 (RA;US)
Roth, J., Enhanced sputtering of graphite at high temperature, 9:50718 (R;US)
Roth, J.A., *See* Olson, G.L., 9:50244
Rothberg, G.M., Extended x-ray absorption fine structure in photoelectron emission, 9:50304 (J;US)
Rouhani, R., *See* Usoro, P.B., 9:49743
Rouse, J.L., *See* Wookey, C.W., 9:50274
Routti, J.T., *See* Peltola, S.S., 9:49720
Roux, J.A., High efficiency parabolic solar collector with glass pipe and black fluid, 9:49704 (R;US)
Rowley, N., Oscillatory structure of the harmonic oscillator Wigner function, 9:50923 (J;GB)
Rowley, R.K., *See* Hurst, G.S., 9:50706
Roy, N., *See* Decman, D.J., 9:50897
Rozgonyi, G.A., *See* Kamgar, A., 9:50154
Rozhkov, V.V., New method for determination of interstitial profiles and sputtering coefficients, 9:50738 (RA;SU;In Russian)
Rubek, J., *See* Bednarik, K., 9:49823
Rubinger, B., *See* Hane, G.J., 9:49943
Rubinstein, F.M., *See* Verderber, R.R., 9:49995, 9:49997
Ruch, J., *See* Katryniok, D., 9:49916

Rudaz, S., *See* Reiss, D.B., 9:50789
Ruedinger, V., Response of HEPA filters to high differential pressures, 9:49869 (RA;DE;In German)
Ruff, R.E., Regional air quality model assessment and evaluation. Final report, 9:50528 (R;US)
Rugg, D., *See* Rinard, G., 9:49755
Rujcheva, M., *See* Tsvetanov, P., 9:49924
Rumpf, H., Stochastic quantization of the linearized gravitational field, 9:50975 (R;AT)
Rundo, J., Current (1984) status of the study of ^{226}Ra and ^{228}Ra in humans at the Center for Human Radiobiology, 9:50608 (R;US)
See Toohey, R.E., 9:50556
Rupertsberger, H., *See* Pietschmann, H., 9:50787
Russell, C.T., Magnetic field of Mars: implications from gasdynamics modeling, 9:50686 (R;US)
See Luhmann, J.G., 9:50716
Russell, D.H., Structure of decomposing $[C_7H_7O]^+$ ions: benzyl versus tropylium ion structures, 9:50338 (J;GB)
Russell, J.E., *See* Handin, J., 9:50665
Russell, R.A., *See* Lippert, T.E., 9:49389
Russo, A.J., Two-dimensional modeling of conduction-mode laser welding, 9:50139 (R;US)
Russo, G., *See* Campisano, S.U., 9:50221
Rutherford, P.H., *See* Peng, Y.K.M., 9:51022
Rutledge, A.K., Facies relationships and reservoir potential of Ohio Creek interval across Piceance Creek basin, northwestern Colorado, 9:49445 (J;US)
Ruvalds, J., *See* Tua, P.F., 9:50212
Ryall, A.S., *See* Vetter, U.R., 9:49727
Ryan, C.G., Measurement of the g-factors of high-spin states in ^{158}Er, 9:50884 (RA;AU)
Rybicka, K., *See* Kramer, C.F., 9:50629
Rydevik, U., *See* Liem, H., 9:49398
Ryytty, C., *See* Olausson, L., 9:49406

S

Saarnio, P., *See* Railio, J., 9:50023
Sabisky, E., Amorphous silicon materials and solar cells: progress and directions, 9:49645 (BA;US)
Saboungi, M.L., Molecular dynamics calculations of MAX_4 melts, 9:50312 (J;US)
Safinya, C.R., Synchrotron x-ray study of the orientational ordering D2-D1 structural phase transition of freely suspended discotic strands in triphenylene hexa-n-dodecanoate, 9:50320 (J;US)
Saha, G.P., Model of commercial energy use in Greater Auckland, 9:50004 (R;NZ)
Saha, H.P., *See* Fischer, C.F., 9:50729
Sahre, P., NIDAC - an on-line program for measurement and anlysis of gamma-ray emitting samples for environmental surveillance, 9:50543 (R;DD;In German)
Saito, E., *See* Yamazaki, O., 9:50025
Salmon, R., Process design and economic evaluation of a conceptual 100,000 bbl/day synthoil plant, 9:49373 (J;US)
Salucci, P., *See* Giannetto, E., 9:50672
Salzman, G.C., Multiparameter light scattering for rapid virus identification, 9:50599 (R;US)
Samarin, V.V., Accounting for temperature dependence at description and simulation of axial channeling, 9:50948 (RA;SU;In Russian)
See Kadmenskij, A.G., 9:50947
Sameh, A.A., *See* Faubel, W., 9:49519
Samuel, M., *See* Reid, J., 9:50788
San Sebastian, J., *See* Ho, T., 9:50642
Sander, H.G., *See* Althoff, M., 9:50763, 9:50764, 9:50765
Sanders, C.O., *See* Vetter, U.R., 9:49727
Sanders, W.T., *See* Burrows, D.N., 9:50691
Sanderson, C.G., Semi-annual report of the Department of Energy, Operational Safety, Health and Environment Division - Quality Assessment Program, 9:50539 (R;US)
Sandstroem, M., *See* Liem, H., 9:49398
Santarsiero, B.D., *See* Waymouth, R.M., 9:50307
Santini, F., Interaction of lower hybrid waves with fast electron tails in FT, 9:50998 (RA;GB)
Santori, G., *See* Cave-Bondi, G., 9:50611
Sapriel, J., Microprobe Raman analysis of picosecond laser annealing of implanted silicon, 9:50218 (BA;NL)
Sargent, T., Radiohalogen-labeled imaging agents. 3. Compounds for measurement of brain blood flow by emission tomography, 9:50595 (J;US)
Sargood, D.G., *See* Mitchell, L.W., 9:50858
See Sevior, M.E., 9:50864
See Tingwell, C.I.W., 9:50859
See Weber, R.O., 9:50853
Sato, I., *See* Onodera, S., 9:50116
Sato, K., *See* Kajiura, S., 9:51044
Satti, J.A., Fermilab satellite refrigerator compressors with oil and moisture removal systems, 9:50468 (BA;US)
Saulys, A.C., BNL multiparticle spectrometer software, 9:50457 (R;US)
Saunders, D.H., Water jet cutting of coal, 9:49409 (R;GB)
Saunders, M.A., *See* Gill, P.E., 9:51062
Sauter, A., *See* Jansky, J., 9:49805
Savolainen, A.L., Some statistical distributions of air particle trajectories near the ground in Finland, 9:50529 (R;FI;In Finnish)
Sawyer, J., *See* Chang, R., 9:49395
Sayers, D.E., *See* Germain, P.J., 9:50245
Sayre, E.V., *See* Hickman, D.A., 9:50294
Scanlan, R.M., *See* Hoard, R.W., 9:51042
Schade, H., *See* Catalano, A., 9:49651
Schaefer, J.F., Progress at the Southwest Residential Experiment Station, 9:49661 (BA;US)
Schardt, D., *See* Roeckl, E., 9:50870
Scharenberg, R.P., *See* Hirsch, A.S., 9:50868
Scharff-Goldhaber, G., Relation between the variable moment of inertia model and the interacting boson model, 9:50924 (BA;JP)
Schaudy, R., Radiation-curable impregnating agents for the conservation of archaelogic wooden objects, 9:50347 (R;AT;In German)
Radiation-curable impregnating agents for the conservation of archaeologic wooden objects. Part 2, 9:50348 (R;AT;In German)
Schehl, R.R., *See* Rao, V.U.S., 9:49582
Schelkoph, G.M., Pyrolysis and devolatilization, 9:49335 (RA;US)
Schepens, G., Biomass and regions: Series fast No. 14. Summary report, 9:49960 (R;LU;In French)
Scherbakov, A., *See* Bartke, E., 9:50478
Schermer, R.I., *See* Boenig, H.J., 9:49903
Schett, A., *See* Bersillon, O., 9:50827
Schicker, J.R., *See* Lula, J.W., 9:50180
Schierholz, G., Hadron spectrum in lattice QCD, 9:50775 (R;DE)
Schiferl, D., *See* Mills, R.L., 9:50202
Schikarski, W.O., DEMONA - research program for the demonstration of nuclear aerosol behaviour, 9:49872 (R;DE;In German)
Schima, F.J., *See* Hurst, G.S., 9:50706
Schimansky, F.P., Neutron induced irradiation damage in amorphous Fe40Ni40B20, 9:50188 (R;DE;In German)
Schlenker, R.A., *See* Rundo, J., 9:50608
Schleuter, W., Contribution to the description of the electrical behaviour of lead, nickel-cadmium, and nickel-iron accumulators, 9:49914 (R;DE;In German)
Schmelzbach, P.A., *See* Ulbricht, J., 9:50832
Schmid, K.R., A single cylinder engine study of lean supercharged operation for spark ignition engines, 9:50083 (BA;US)
See Johnson, R.T., 9:50084
Schmidt, F., *See* Pflueger, H., 9:49798
Schmidt, G.L., *See* Houlberg, W.A., 9:51024
Schmidt, T., Evaluation of the weldability of heavy-section forgings with special emphasis of segregated areas, 9:50122 (RA;DE;In German)
Schmidt, T.R., *See* Reed, A.W., 9:49899
Schmitz, D., *See* Althoff, M., 9:50763, 9:50764, 9:50765
Schmoede, P., *See* Katryniok, D., 9:49916
Schneibel, J.H., *See* Yoo, M.H., 9:50103
Schneider, E., *See* Hoeller, P., 9:49807
Schneider, J., Studies of extremely neutron-deficient isotopes near the proton shell Z = 82, 9:50882 (R;DE;In German)
Schneider, K., *See* Tolksdorf, E., 9:50118
Schneider, W.J., Novel shield support for coal faces worked by shearer loaders in difficult geological conditions with modern ergonomic layout, 9:49410 (R;DE;In German)
Schneidmiller, D., *See* Swan, F.E. Jr, 9:49771
Schnier, C., Development and application of an iridium tracer for tracking tailings in the central Red Sea, 9:50569 (R;DE)
Schnitzer, H.J., *See* Grisaru, M.T., 9:50814
Schoeberl, F., *See* Falkensteiner, F., 9:50786
Schoenauer, W., Development of self-adaptive difference method for the solution of three-dimensional laminar

incompressible boundary layer equations with arctrolled error, 9:50403 (R;DE;In German)
Schoenborn, B.P., Data processing in neutron protein crystallography using position-sensitive detectors, 9:50492 (BA;GB)
Schoenecke, P.L., *See* Nemzek, T.A., 9:49933
Schramm, D.N., Quark-hadron and chiral transitions and their relation to the early universe, 9:50710 (J;NL)
Schubert, J., Chelation and effectiveness of salicylate related compounds on pyresis, sedimentation rate and hematocrit, 9:50633 (R;US)
Schueck, C., Properties of quasi neutron configurations in 165FYb at very large angular frequencies. Interpretation in terms of gradual neutron pairing decrease, 9:50896 (BA;JP)
Schuerenkraemer, M., *See* Barthels, H., 9:49780
Schuessler, H.A., Topics in high resolution spectroscopy of stored ions, 9:50728 (R;US)
Schuettelkopf, H., Radioecological research on the behavior of actinides in the environment, 9:49870 (RA;DE;In German)
Schultz, A.J., *See* Strauss, M.G., 9:50488
Schultz, J.C., Photoelectron spectroscopy of 1-propyl, 1-butyl, isobutyl, neopentyl, and 2-butyl radicals: free radical precursors to high-energy carbonium ion isomers, 9:50357 (J;US)
Schulz, R., *See* Bowman, R.C. Jr., 9:50163
Schulze, H.D., *See* Bernecker, G., 9:50117
Schuss, J.J., *See* Lloyd, B., 9:50997
Schwabl, F., Propagation of sound at continuous structural phase transitions, 9:50941 (R;US)
Schwartz, R.A., High resolution hard X-ray spectra of solar and cosmic sources, 9:50684 (R;US)
Schwartz, S.E., *See* ten Brink, H.M., 9:50520
Schwarz, J., *See* Lagerstedt, G., 9:49748
Schwarz, N.F., Operating experience with potassium systems, 9:49750 (R;AT)
Schwarz, W., *See* Jones, G. II, 9:50345
Schwarzbach, K., Trends in the development of new pipe systems for power plants, 9:49856 (RA;DE;In German)
Schweighardt, F.K., *See* Kang, D., 9:49346
Schweitzer, S., *See* Anand, D.K., 9:49699
Schweizer, C., *See* Ulbricht, J., 9:50832
Scott, A.C., *See* Chandra, J., 9:50387
Scott, L.W., Electric arcing at high voltage during methane-air explosions inside explosion-proof enclosures. Technical progress report, 9:50364 (R;US)
Sdouz, G., Austrian contributions to fuel rod failure models shown at the International Standard Problem ISP-14, 9:49896 (R;AT;In German)
See Kamelander, G., 9:49895
Sealock, L.J. Jr., Development of an advanced water-gas shift conversion system. Monthly project status report No. 6, September 1-30, 1984, 9:49357 (R;US)
See Lyke, S.E., 9:49341
Sealock, R.M., Target damage in MeV ion beam microanalysis of biological tissue, 9:50275 (RA;AU)
See Mazzolini, A.P., 9:50276
Sealock, Z.J., *See* Lyke, S.E., 9:49368
Sears, D.R., *See* Henke, K.R., 9:49427
Sears, R.E., *See* Baker, G.G., 9:49421
Sedlacek, J., Hybrid model of reactor neutron power control, 9:49820 (RA;CS;In Czech)
Seeger, P.A., Fast parallel encoding scheme for the Anger camera, 9:50491 (BA;GB)
Seeger, T., *See* Cornec, A., 9:50111
Seestrom-Morris, S.J., *See* Morris, C.L., 9:50847
Sefko, J., Laminated grid and web magnetic cores, 9:50385 (P;US)
Segalyn, P.L., *See* Rich, F.J., 9:50715
Segers, D.P., Multiple luminescence from borohydridobis(triphenylphosphine) copper(I), 9:50305 (J;US)
Seibert, K.D., *See* Burgess, V.E., 9:50054
Selby, J.M., *See* Kenoyer, J.L., 9:50486
Selcuk, M.K., Nomographic methodology for use in performance trade-off studies of parabolic dish solar power modules, 9:49664 (R;US)
Selig, W., Constant-current potentiometric titration of orthophosphate with cetylpyridinium chloride: a feasibility study, 9:50295 (J;GB)
Selig, W.S., Kitchensink titrations, 9:50303 (R;US)
Sellin, I.A., Anomalous mean free paths for scattering of convoy electrons generated by fast, highly ionized ions in thin solid targets, 9:50725 (R;US)
Forward electron production in heavy ion-atom and ion-solid collisions, 9:50723 (R;US)
Selvam, R.P., *See* Vallabhan, C.V.G., 9:49708
Semenoff, G.W., *See* Niemi, A.J., 9:50810
Semerad, E., Observation of single phonon scattering of Ne^{20}-atoms from a LiF (001) surface, 9:50749 (R;AT)
Sengupta, S., *See* Gerrish, H.P., 9:49581
Sergeev, F.M., Capture of pions by nuclei, 9:50912 (RA;SU;In Russian)
Serpan, C.Z. Jr., US NRC research on the integrity of piping in nuclear reactor primary systems, 9:49768 (RA;DE)
Seth, D.L., *See* Nelson, P., 9:50932
Sevior, M.E., $^{41}K(p,\alpha)^{38}Ar$ cross section and its significance for nucleosynthesis, 9:50864 (RA;AU)
See Mitchell, L.W., 9:50858
See Tingwell, C.I.W., 9:50859
See Weber, R.O., 9:50853
Seybold, G., *See* Iden, R., 9:49703
Sgarbazzini, M., *See* Cave-Bondi, G., 9:50611
Sha, J.Y., *See* Toohey, R.E., 9:50556
Shackleton, M., *See* Chang, R., 9:49395
Shadrin, V.N., *See* Adeev, G.D., 9:50736
Shafer, W.E., *See* McClish, R.F., 9:49491
Shah, R.R., *See* Khondker, A.N., 9:50247
Shaked, H., *See* Pinto, H., 9:50114
Shalek, P.D., *See* Hurley, G.F., 9:50174
Shana, J.Yu., Combined fluidized bed retort and combustor, 9:49497 (P;US)
Shannon, J.D., *See* Ruff, R.E., 9:50528
Shannon, J.M., *See* McMillan, G.B., 9:50238
Shapira, H., *See* Bircher, C., 9:49690
Sharma, D.K., Generator monitoring and surveillance: workshop proceedings, 9:49747 (R;US)
Shea, C.M., *See* Geard, C.R., 9:50617
Sheih, C.M., *See* Ruff, R.E., 9:50528
Shekherov, D., *See* Radicheva, M., 9:49830
Shekherov, L., Gamma-ray emitting radionuclides in environmental samples from the South-West Bulgaria, 9:50558 (RA;BG;In Bulgarian)
Joint comparative research on gamma-ray emitting radionuclides in samples from the Danube-Black Sea territorial complex, 9:50559 (RA;BG;In Bulgarian)
See Radicheva, M., 9:49829
Sheldon, E., Evaluation of (n,n') scatteriung cross sections from 0.8 to 2.5 MeV for higher collective bands of ^{232}Th and ^{238}U in "standard" (CN + DI) and "unified" (Weidenmerller s-matrix) formalisms, 9:50925 (B;US)
Shell, P.K., Solar heated rotary kiln, 9:49697 (P;US)
Shelton, E.M., Diesel fuel oils, 1983, 9:49472 (R;US)
Shen, S., Sonic resonator control and method for determining component concentration in multiple component molten liquids, 9:50146 (P;US)
Sheng, T.T., *See* Celler, H.K., 9:50229
Shepard, K.W., Status of rf superconductivity at Argonne National Laboratory, 9:50458 (R;US)
Shibata, K., Evaluation of neutron nuclear data for ^{12}C, 9:50844 (R;XN)
Shibata, Keiichi, Neutron nuclear data of ^{7}Li adopted in JENDL-2, 9:50845 (R;JP)
Neutron nuclear data of ^{9}Be adopted in JENDL-2, 9:50846 (R;JP)
Shifman, M.A., *See* Khoze, V.A., 9:50785
Shilova, M.V., *See* Sorvina, V.P., 9:50199
Shimizu, M., *See* Kajiura, S., 9:51044
Shimizu, T., *See* Kajiura, S., 9:51044
Shindler, J., *See* Turner, L.R., 9:51031
Shipatov, Eh.T., *See* Grazhdankin, V.N., 9:50740, 9:50741
See Kovaleva, E.A., 9:50739
Shipley, W.D., *See* Kibbe, R.K., 9:51028
Shirk, D.G., Monte Carlo error analysis in x-ray spectral deconvolution, 9:50481 (R;US)
Shirley, D.A., *See* Liu, G., 9:50746
Shirley, F.W., Battelle's Multi-Solid Fluidized Bed Oil Shale Retort, 9:49498 (BA;US)
Shiue, C.Y., ^{18}F-4-fluoroantipyrine, 9:50355 (P;US)
Shockey, G.C., *See* Jepson, B.E., 9:50311
Short, K.T., Study of coherent precipitation of antimony in silicon using He^{+} ion channeling and electron microscopy, 9:50191 (RA;AU)
Short, T.H., *See* Bauerle, W.L., 9:50000
Shugart, H.H., *See* Dale, V.H., 9:50548
See Emanuel, W.R., 9:50523
Shul'ga, N.F., Rainbow scattering and relativistic electron radiation in crystals at motion along axis, 9:50953 (RA;SU;In Russian)
Shul'gin, B.V., *See* Bagaev, V.N., 9:50742
Shulgin, A.T., *See* Sargent, T., 9:50595
Shults, W.D., Matrix scientist in a matrix organization, 9:50261 (R;US)
Shute, G.G., *See* Andrews, P.R., 9:50842

See Banks, S.M., 9:50863
See Wastell, J.M.R., 9:50862
Shyu, C.M., *See* Cheng, L.J., 9:49637
Siblia, C., *See* Bertolotti, M., 9:50251
Sickles, J.E., *See* Kashdan, E.R., 9:50533
Sie, S.H., *See* Ryan, C.G., 9:50884
Siebke, H., *See* Althoff, M., 9:50764, 9:50765
Siegel, B.Z., *See* Siegel, S.M., 9:50536
Siegel, J.J., Utility financial stability and the availability of funds for decommissioning, 9:49787 (R;US)
Siegel, S.M., First estimate of annual mercury flux at the Kilauea main vent, 9:50536 (J;GB)
Siegman, A.E., *See* Fauchet, P.M., 9:50253
Sienko, M.J., Thin film synthesis of superconducting chemical compounds. Final report 1 January 1981-30 December 1983, 9:50182 (R;US)
Sievert, D., Electricity production cost in coal and nuclear power plants, 9:49794 (R;DE;In German)
Siffert, P., *See* Fogarassy, E., 9:50222
Simmons, R.O., *See* Marx, S.V., 9:50207
Simon, W., Gravitational field strength and generalized Komar-integral, 9:50976 (R;AT)
Simonen, F.A., *See* Bampton, M.C.C., 9:49898
Simons, G., *See* Ham, D., 9:49339
Simpson, B.J., Low head, micro-hydro demonstration project, Coker, Alabama. Final report, 9:49595 (R;US)
Simpson, J.C., *See* Gilbert, R.O., 9:50561
Singer, C.E., *See* Houlberg, W.A., 9:51024
See Mikkelsen, D.R., 9:51014
Singer, J.R., *See* Green, M.A., 9:50596
Singer, S.F., Has the energy crisis passed, 9:49946 (RA;US)
Singh, L., *See* Somayajulu, Y.V., 9:50717
Singh, S.P.N., *See* Villiers-Fisher, J.F., 9:49360
Sinn, J.P., Uptake rate of nitrogen dioxide by potato plants, 9:50639 (J;US)
Siomos, K, Multiphoton ionization of benzene in solution, 9:50334 (R;US)
Sjoestrand, T., Merging of jets, 9:50778 (R;DE)
Sjoreen, A.L., *See* Kocher, D.C., 9:49540
Sjoreen, T.P., *See* Bertrand, F.E., 9:50880
Skala, Z., Control and evaluation part of equipment for testing WWER 440 pressure vessels, 9:49773 (RA;CS;In Czech)
Skiles, J.J., *See* Albuyeh, F., 9:49761
Skinner, D.M., *See* Mykles, D.L., 9:50600, 9:50601
Sklad, P.S., Reliability of the quantification of EELS measurements, 9:50158 (R;US)
See McHargue, C.J., 9:50159
See White, C.W., 9:50157
Sklar, E., Fourier-transform ring laser, 9:50397 (J;US)
Skothein, T., Photoelectrochemical cells for conversion of solar energy to electricity and methods of their manufacture, 9:49630 (P;US)
Slane, J.M., *See* Toohey, R.E., 9:50556
Slberberg, R., *See* Adams, J.H. Jr., 9:50677
Slim, H.A., Gluon propagator in quantum chromodynamics, 9:50806 (RA;AU)
Slingsby, J.A., *See* Cluett, C., 9:49558
Slonski, M., *See* Bluhm, S., 9:49939
Slonski, M.L., Survey of cogeneration: advanced cogeneration research study, 9:49941 (R;US)
Smedegaard, J., Low-temperature heat utilization in production of electric or mechanical power Organic Rankine Cycle System. Part-report comprehending instrumentation and computer measurement program, 9:50440 (R;DK;In Danish)
Smeltzer, E.E., *See* Ciliberti, D.F., 9:49394
Smiley, R.H., *See* Oliver, H.W., 9:50509
Smit, F.J., Ultra-fine coal characterization. 2nd quarterly report, June 1, 1984-August 31, 1984, 9:49383 (R;US)
Smith, A.J., *See* Chidley, B.E., 9:49526, 9:49528
Smith, E.D., *See* Kocher, D.C., 9:49540
Smith, G.P., Chemical reactions among the components in $SbCl_3$-$AlCl_3$-Sb melts, 9:50313 (J;US)
See Buchanan, A.D., 9:50326
See Chapman, D.M., 9:50325
See Zingg, S.P., 9:50327
Smith, G.R., Signal Hill solar-powered repeater report and recommendations, 9:49653 (R;US)
Smith, J.L., Actinides: from heavy fermions to plutonium metallurgy, 9:50132 (R;US)
Smith, J.W., *See* Wolf, G.A., 9:50216
Smith, M.F., *See* Edmonds, P.H., 9:51027
Smith, R., *See* Kondo, Y., 9:50849, 9:50850, 9:50852
Smith, Z.E., *See* Catalano, A., 9:49651
Smolik, J., *See* Majer, J., 9:49821
Snaddon, R.W.L., Interstitial flow intensification within packed granular bed filters: Experiments and theory, 9:50439 (J;US)
Socolow, R.H., *See* Fels, M.F., 9:49991
Soerensen, J.L., Use of basin ash as fill material on dry level, 9:49396 (R;SE;In Danish)
Use of conditioned fly ash as fill material, 9:49397 (R;SE;In Danish)
Sokachev, E., *See* Ogievetskij, V., 9:50957
Solari, J.S., Conservation as part of a utility market plan: lessons learned, 9:50048 (RA;US)
Solash, J., *See* Cronauer, D.C., 9:49499
Soln, J., Uniform magnetic-field-induced free-electron laser in a waveguide, 9:50390 (R;US)
Solomon, A.M., Simulating responses to expected climate change in eastern North America: applications to decision-making in the forest industry, 9:50547 (R;US)
Somayajulu, Y.V., Multistation study of nighttime scintillations in low latitudes: evidence of control by equatorial F region irregularities, 9:50717 (J;US)
Sommers, G.L., *See* Rinehart, B.N., 9:49592
Somorjai, G.A., Structure of adsorbed monolayers. The surface chemical bond, 9:50744 (R;US)
Sondericker, J.H., Automation of a cryogenic facility by commercial process control computer, 9:50472 (BA;US)
Song, J.C., Transient axial solid and gas temperature profiles in the grid zone of a gas-solid fluidized bed, 9:50435 (J;US)
Sonnenberger, D.C., *See* Morss, L.R., 9:50297
Sorlie, M., *See* Chapman, D.M., 9:50325
See Smith, G.P., 9:50313
See Zingg, S.P., 9:50327
Soroka, K.E., *See* Dalverny, L.E., 9:49415
Sorvina, V.P., Residual damage in GaAs annealed layers bombarded by silicon ions, 9:50199 (RA;SU;In Russian)
Sosnowski, M., Determination of threshold and maximum operating electric stresses for selected high voltage insulations. Task III. Investigation of high voltage capacitor insulation. Progress report No. 4, 9:49759 (R;US)
Soung, W.Y., Recovery of alkali metal constituents from catalytic coal conversion residues, 9:49363 (P;US)
Spaar, M.T., *See* Nave, S.E., 9:50102
Spalvins, T., Frictional and morphological properties of Au-MoS2 films sputtered from a compact target, 9:50204 (R;US)
Spang, S.T., *See* Jory, H.R., 9:51035
Sparks, C.J. Jr., X-ray microprobe characterization of materials: the case for undulators on advanced storage rings, 9:50260 (R;US)
Spear, R.H., *See* Burnett, M., 9:50874
See Vermeer, W.J., 9:50841
Spice, B.M., *See* Banks, S.M., 9:50863
Spicer, B.M., Future directions in intermediate energy nuclear physics, 9:50826 (RA;AU)
See Andrews, P.R., 9:50842
See Harrigan, M.F., 9:50734
See Wastell, J.M.R., 9:50862
Spicer, C.W., *See* Holdren, M.W., 9:50574
Spicer, L.D., Method of preparing $(CH_3)_3SiNSO$ and byproducts thereof, 9:50292 (P;US)
Spohn, C., *See* Gindele, K., 9:49620
Squires, A.M., Small coal furnaces: the neglected option, 9:49425 (RA;US)
Srivastava, D.K., Dynamic density dependence of the alpha-nucleon force in folding models of inelastic scattering of alpha-particles, 9:50865 (R;DE)
Srivastava, V.C., D-T axicell magnet system for MFTF-α+T, 9:51021 (R;US)
St. John, M., *See* Anderson, G.L., 9:49342
Staats, P.A., *See* Casson, W.H., 9:51002
Stahara, S.S., Application of a global solar wind/planetary obstacle interaction computational model: Earth, Venus, Mars, Jupiter, and Saturn studies, 9:50685 (R;US)
Stahlkopf, K.E., Pressurized thermal shock program sponsored by EPRI, 9:49772 (RA;DE)
Stallmann, F.W., LSL-M1 and LSL-M2: two extensions of the LSL adjustment procedure for including multiple spectrum locations, 9:49797 (R;US)
ORNL evaluation of the ORR-PSF metallurgical experiment and blind test, 9:49833 (R;US)
Stamm, H., Effect of cyclic thermal shock loading on crack growth behavior, 9:50130 (RA;DE;In German)
See Czuck, G., 9:49804
Stancheva, N., *See* Khristov, V., 9:50930
Stange, A., *See* Iden, R., 9:49703
Stanolov, A., *See* Khristov, V., 9:50930
Starace, A.F., *See* Clark, C.W., 9:50753

Stark, N., Physical and chemical problems with reclamation of conifers, 9:49412 (R;US)
Start, D.F.H., Non-inductive current drive in tokamaks, 9:51000 (R;GB)
See Cox, M., 9:50985
Stassinopoulos, E.G., TOPEX orbital radiation study, 9:50695 (R;US)
Stateham, R.M., *See* Moebs, N.N., 9:49416
Statton, C.T., Subsidence monitoring in conjunction with methane gas production in Louisiana (phase 1, deep well program). Annual report November 1981-January 1983, 9:49481 (R;US)
Staunton, J.B., *See* Gyorffy, B.L., 9:50945
Steadman, E.N., *See* Benson, S.A., 9:49380
Stebbings, J.H., *See* Rundo, J., 9:50608
Steedman, W.G., *See* Shirley, F.W., 9:49498
Stefan, D., *See* Gajst, F., 9:50198
Stefanov, G., *See* Shekherov, L., 9:50558, 9:50559
Steffen, K., Complete snake and rotator schemes for spin polarization in proton rings and large electron rings, 9:50473 (R;DE)
Stegemann, D., *See* Grondey, G., 9:49769
Stehney, A.F., *See* Rundo, J., 9:50608
Stehno, G., *See* Donhoffer, D., 9:50291
Steigman, G., The universe strikes back, 9:50711 (BA;US)
Stein, G., *See* Mueller, R., 9:49569
See Reuters, H., 9:49570
Stein, U., *See* Haag, R., 9:50704
Steinebach, E.F.M., *See* Mueller, R., 9:49569
Steinfeld, G., *See* Grindley, T., 9:49340
Steinke, R., Nuclear Plant Analyzer: an interactive TRAC/RELAP Power-Plant Simulation Program, 9:49886 (R;US)
Steinkopff, H., *See* Reinfried, D., 9:49778
Steinpichler, D., *See* Frevert, E., 9:49573
Stekl, J., *See* Chvalova, J., 9:49774
Stember, L.H., Reliability, availability and maintenance-costs models for use in the design of photovoltaic power systems, 9:49658 (BA;US)
Stepanov, K.N., *See* Grekov, D.L., 9:50995
Stephens, A.G., BWR Full Integral Simulation Test (FIST) program: facility description report, 9:49889 (R;US)
Stephenson, J., *See* Ang, S.T., 9:50003
Sterman, J.D., Experiment to evaluate methods for estimating fossil fuel resources, 9:49444 (R;US)
Stevens, H., *See* Genens, L., 9:49681
Stevens, J., *See* Motley, R., 9:50999
Stevens, R.R., *See* York, R.L., 9:50463
Steverson, J.A., *See* Henry, E.B., 9:49765
Steward, M.E., *See* Brengle, T.A., 9:51013
Stewart, D.L., *See* Pelroy, R.A., 9:50637
Stewart, G.W., *See* Stinespring, C.D., 9:49432
Stewart, R., *See* Wong, S., 9:50394
Stewart, W.L., Problems of small, high-technology firms, 9:49926 (R;US)
Stieff, L.R., Feasibility of the use of nuclear-emulsion techniques in the study of drill core and water samples from the Monticello mill, Monticello, Utah, 9:49568 (R;US)
Stika, K.M., *See* Cheng, L.J., 9:49637
Stine, W.B., Survey of manufacturers of high-performance heat engines adaptable to solar applications, 9:49665 (R;US)
Stinebaugh, R.E., Underground system for disposal of contact handled transuranic waste at the potential Yucca Mountain repository, 9:49559 (R;US)
Stinespring, C.D., Chemical effects of entrained particles in coal conversion streams: prediction of PFBC alkali levels, 9:49432 (RA;US)
Stinton, D.P., Fabrication of ceramic-ceramic composites by chemical vapor deposition, 9:50173 (R;US)
Stipp, P., *See* Bellinghausen, B., 9:50828
Stirsky, P., *See* Bednarik, K., 9:49823
Stockdale, J.A.D., *See* Compton, R.N., 9:50721
See Dodhy, A., 9:50719
Stocks, G.M., *See* Gyorffy, B.L., 9:50945
Stoetzel, G.A., *See* Gillings, J.C., 9:49897
Stoll, W., Technological-economic considerations of the production of uranium by the amalgam process, 9:49509 (TJ;US)
Stone, M.W., *See* Hodge, G.A., 9:50467
Stone, R.M., *See* Nemzek, T.A., 9:49933
Stoppler, W., *See* Roos, E., 9:49809
Storms, E.K., Thermionic emission and vaporization behavior of the ternary systems of lanthanum hexaboride containing molybdenum boride, molybdenum diboride, zirconium diboride, gadolinium hexaboride, and neodymium hexaboride, 9:50168 (J;US)
Stoughton, R.S., Automatic camera tracking for remote manipulators, 9:49516 (R;US)
Strakhovenko, V.M., *See* Bajer, V.N., 9:50197, 9:50954
Stram, D.O., *See* Fels, M.F., 9:49991
Strand, G., *See* Becker, K.M., 9:49885
Strauss, M.G., Spatial resolution of neutron-position scintillation detectors, 9:50488 (BA;GB)
Strayer, M.R., Chaos near the Coulomb barrier. Nuclear molecules, 9:50833 (R;US)
Nuclear molecules in TDHF, 9:50834 (R;US)
Strickland, L.D., Status and overview of surface coal gasification, 9:49337 (RA;US)
Stringfellow, B.C., *See* Hirsch, A.S., 9:50868
Strizhov, V.F., *See* Eremin, N.V., 9:50854, 9:50855
Strunce, R.R., *See* Birdwell, J.D., 9:50380
Stuart, F.P., *See* Rosenow, M.K., 9:50597
Stuchbery, A.E., Polarization transfer to inner-vacancies of ions swiftly traversing polarized ion hosts, 9:50730 (RA;AU)
Variations of the gyromagnetic ratios of corresponding states in ^{189} ^{190} ^{192}Os - measurements and interpretations, 9:50889 (RA;AU)
Stuck, R., *See* Fogarassy, E., 9:50222
Stulen, F.B., *See* Kiefner, J.F., 9:49486, 9:49487
Stultz, T., Beam processing of silicon with a scanning CW Hg lamp, 9:50236 (BA;NL)
Sturm, J., *See* Stultz, T., 9:50236
Sturrock, P.A., Extragalactic radio sources, 9:50690 (R;US)
Subramanian, R., Luminescence behavior as a probe for phase transitions and excimer formation in liquid crystals: dodecylcyanobiphenyl, 9:50341 (J;NL)
Sue, J.J., Effect of Ta additions upon in situ prepared Nb_3 Sn-Cu superconducting wire, 9:50386 (J;US)
Suffridge, F.E., Project evaluation: Penn Grade Micellar Displacement Project, 9:49446 (R;US)
Sugama, T., Hydrothermal durability of Ca-complexed methylmethacrylate-trimethylolpropane trimethacrylate copolymer films and coatings containing superficially formed CaO-SiO_2-H_2O type inorganic macromolecules, 9:50172 (R;US)
Suitor, J.W., *See* Marner, W.J., 9:50052
Sullivan, J.D., *See* Moltz, D.M., 9:50867
Sun, J.D., Respiratory tract clearance of ^{14}C-labeled diesel exhaust compounds associated with diesel particles or as a particle-free extract, 9:50641 (J;US)
Susman, S., *See* Brun, T.O., 9:49915
Sutherland, B.M., Towards a molecular understanding of sunlight-induced skin cancer in mouse and man, 9:50602 (R;US)
Sutin, N., *See* Mok, C.Y., 9:50336
Suzuki, K., *See* Onodera, S., 9:50116
Suzuki, Katsumi, *See* Ito, Kazutoshi, 9:49832
Suzuki, Mamoru, *See* Ito, Kazutoshi, 9:49832
Svab, E., Neutron diffraction experiments on amorphous alloys, 9:50131 (R;HU)
Svanberg, S., *See* Alden, M., 9:50077
Swan, F.E. Jr, Evaluation of on-line chelant addition dilute chemical cleaning. Final report, 9:49771 (R;US)
Swan, P.D., *See* Foote, J.H., 9:50680
Swanson, J.L., *See* Chick, L.A., 9:49557
Swanson, M.L., *See* Dollimore, J., 9:49334
Swartz, C.K., *See* Weizer, V.G., 9:49613
Swartz, G., *See* Catalano, A., 9:49651
Swift, M.A., Adapting state and national electricity consumption forecasting methods to utility service areas. Final report, 9:49956 (R;US)
Swindeman, R.W., *See* Yoo, M.H., 9:50103
Swint, M.J., The U.S. Transuranium Registry: The final contribution or ultimate gift, 9:50623 (J;US)
Swith, K.L., *See* Gillings, J.C., 9:49897
See Kenoyer, J.L., 9:50486
Symons, T.J.M., *See* Olson, D.L., 9:50482
Syratt, W.J., *See* James, P.W., 9:49466
Szegoe, K., *See* Hrehuss, G., 9:50673
Szekely, J., Mathematical model of the electric arc furnace. Final report, 9:50036 (R;US)
Szyper, J.P., *See* Bienfang, P.K., 9:50565

T

Tajima, T., *See* Mako, F.M., 9:50450
Takacs, P.Z., *See* Church, E.L., 9:50365
Takacs, R.A., *See* Bunnell, R.E., 9:50508
Takahashi, K., *See* Mathews, G.J., 9:50703
Takakura, T., *See* Costa, J.E.R., 9:50688
Tamura, T., *See* Boegly, W.J. Jr., 9:49541
See Lenske, H., 9:50857

Tanaka, N., Air heat source heat pump chiller with a new refrigerant flow rate control, 9:50026 (TJ;US)
Tanase, M., Isothermal equilibrium pressures of a Y-Nb alloy-H_2 system, 9:50310 (J;CH)
Tardella, Q., *See* Cave-Bondi, G., 9:50611
Tarrer, A.R., New and improved dispersion and recovery techniques for slurry phase catalysis. Quarterly report, January-March, 1984, 9:49355 (R;US)
Tarrh, J.M., *See* Becker, H., 9:51040
Tashlykov, I.S., Method of light ion backscattering combined with channeling for analysis of radiation damage types in implanted gallium arsenide, 9:50195 (RA;SU;In Russian)
See Plashchinskij, G.I., 9:50123
Tassoni, E., Geologic disposal of radioactive waste. An in situ heating experiment in clay rock, 9:49550 (R;IT;In Italian)
Tatarchuk, B.J., *See* Tarrer, A.R., 9:49355
Taylor, K.J., Corrosion studies on containment materials for vitrified high level nuclear waste. Annual progress report for 1983, 9:49532 (R;GB)
Taylor, R.B., *See* Hicks, G., 9:50873
Teansomprasong, P., *See* Hicks, G., 9:50873
Teegarden, B.J., *See* Pizzichini, G., 9:50713
Temming, S.J., *See* Davies, G.R., 9:50001
ten Brink, H.M., Attempted measurement of gaseous H_2O_2 in the ambient atmosphere, 9:50520 (R;US)
Tenforde, T.S., *See* Curtis, S.B., 9:50618
Ter Haar, G.L., Lead uptake by perennial ryegrass and radishes from air, water and soil, 9:50650 (J;CA)
Ternouth, J.H., *See* Thomas, B.J., 9:50280
Terrell, J., X-ray emission from Centaurus A, 9:50674 (R;US)
Tesarek, H., Reduction of emission of particles, carcinogenic polycyclic hydrocarbons and nitric oxides of a direct injection diesel engine by the diesel-gas process, 9:50081 (R;DE;In German)
Testa, L., *See* Tassoni, E., 9:49550
Tetel'baum, D.I., *See* Pavlov, P.V., 9:50128
See Sorvina, V.P., 9:50199
Teufel, L.W., Model for fracture genesis: application to Mesaverde group, Piceance Creek basin, Colorado, 9:49476 (J;US)
Thaller, B., *See* Mitter, H., 9:50970
Theilacker, J., Commissioning of the Tevatron Satellite Refrigeration system, 9:50471 (BA;US)
Control of the Tevatron Satellite Refrigeration system, 9:50470 (BA;US)
Themelis, M.P., *See* Forman, S.E., 9:49648
Theroux, G.L., *See* Oliver, H.W., 9:50509
Thiessen, H.A., LAMPF II, 9:50447 (R;US)
Thomas, B.J., Measurement of lean body mass in animals by thermal neutron capture gamma-ray analysis, 9:50280 (RA;AU)
Thomas, G., International Nuclear Target Development Society workshop 1983: proceedings, 9:50456 (R;US)
Transmission electron microscopy of inorganic materials, 9:50092 (R;US)
Thomas, G.E., Evaluation of target purity using various vacuum systems, 9:50460 (R;US)
Thomas, M.Z., *See* Vaughn, J.M., 9:50566
Thomas, W., Safety strategy for the use of plutonium, 9:49793 (R;DE;In German)
Thomason, H.P., *See* Chidley, B.E., 9:49526
Thompson, A., *See* Osullivan, D., 9:50676
Thompson, L., EPRI research on hydrogen combustion and control, 9:49866 (RA;DE)
See Berman, M., 9:49865
Thompson, L.F., *See* Holmes, S.A., 9:49503
Thompson, M.N., Photonuclear reactions in light nuclei, 9:50830 (RA;AU)
See Facci, M., 9:50840
See O'Keefe, G.J., 9:50861
See Rassool, R.P., 9:50875, 9:50877
See Zubanov, D., 9:50843
Thompson, M.O., *See* Clark, G.J., 9:50153
See Gyuali, J., 9:50233
Thompson, R.C., Neptunium revisited, 9:50625 (J;US)
See Appelman, E.H., 9:50306
Thorne, J.M., *See* Jensen, R.J., 9:50309
Thorne, M.C., *See* Coughtrey, P.J., 9:49536
Thornton, M.M., *See* Malte, P.C., 9:49589
Thurenius, B., *See* Liem, H., 9:49398
Thurnay, K., KANDY - a numerical model to describe phenomena, which - in a heated and voided fuel element of an LMFBR - may occur, 9:49882 (R;DE;In German)
Tielens, T.A.A., Systematics of nuclear level densities. Chapter V, 9:50866 (RA;NL)
Timm, B., *See* Olausson, L., 9:49406
Timmerman, C.L., *See* Oma, K.H., 9:49556
Tingwell, C.I.W., $^{58}Ni(p,\gamma)^{59}Cu$ cross section and its importance for nucleosynthesis and statistical model studies, 9:50859 (RA;AU)
See Mitchell, L.W., 9:50858
See Sevior, M.E., 9:50864
See Weber, R.O., 9:50853
Tischer, A., *See* Heinicke, W., 9:49796
Tobias, C.A., Response of sensitive human Ataxia and resistant T-1 celi lines to accelerated heavy ions, 9:50627 (J;GB)
See Woodruff, K.H., 9:50626
Tobin, R.L., *See* Friecsz, T.L., 9:50033
Todorov, T., Theory of generalized observables in quantum mechanics, 9:50956 (RA;BG;In Bulgarian)
See Khristov, Kh., 9:50979
Tolksdorf, E., Toughness behaviour of the steel X 20 CrMoV 12 1. Results of optimizing the base- and weld metal, 9:50118 (RA;DE)
Tolley, H.D., *See* Ballou, J.E., 9:50620
Toman, M.A., Risk aversion and the insurance value of strategic oil stockpiling, 9:49458 (R;US)
See Bohi, D.R., 9:49459
See Murphy, F.H., 9:49457
Tomoda, Y., *See* Zimmermann, C., 9:50121
Tomov, L., *See* Kolev, N., 9:49825
Toohey, R.E., Activity ratios of thorium daughters in vivo, 9:50556 (R;US)
Torsethaugen, K., *See* Faevelen, M, 9:50515, 9:50516, 9:50517
Tortorici, L.D., *See* LeBrun, T.J., 9:50551
Toth, K.S., *See* Moltz, D.M., 9:50867
Townley, C.H.A., *See* Crossley, M.R., 9:49802
Towse, D., Feasibility study: vertical fracturing in directionally drilled wells. Final report, January 1983-September 1983, 9:49482 (R;US)
Travelli, A., RERTR Program: goals, progress and plans, 9:49834 (R;US)
Travis, C.C., Inhalation pathway risk assessment of hazardous waste incineration facilities, 9:50636 (R;US)
Treado, S., *See* Gillette, G., 9:50006
Triano, A., *See* Catalano, A., 9:49651
Tribble, R.E., *See* Moltz, D.M., 9:50867
Trivich, D., Cu/Cu2O cells prepared by hydrogen bombardment, 9:49643 (BA;US)
Troost, W., *See* Berends, F.A., 9:50772, 9:50773
Truten', V.I., *See* Shul'ga, N.F., 9:50953
Tsang, C.F., *See* Doughty, C., 9:49908
Tsang, K.L., *See* Chen, Y., 9:50208
Tsankov, L., *See* Manushev, B., 9:50578
Tsao, C.H., *See* Adams, J.H. Jr., 9:50677
Tsatsaronis, G., Thermoeconomic analysis of power plants. Final report, 9:50431 (R;US)
Tsaur, B.Y., Electrical characteristics and device applications of zone-melting-recrystallized Si films on SiO_2, 9:50231 (BA;NL)
Tschoegl, N.W., Effect of pressure on the mechanical properties of polymers. Part II. Measurement of the time-dependent Poisson's ratio. Final report, 9:50177 (R;US)
Tseytlin, A.A., *See* Fradkin, E.S., 9:50965, 9:50966
Tsukada, H., *See* Onodera, S., 9:50116
Tsvetanov, P., Methods and models for system assessment of long-term development of energy complex of People's Republic of Bulgaria, 9:49924 (RA;BG;In Bulgarian)
Tsytovich, V.N., *See* Bakos, J.S., 9:51008
Tua, P.F., Josephson-type oscillations in a moving charge-density wave interacting with magnetic impurities, 9:50212 (J;US)
Tuccillo, A., *See* Santini, F., 9:50998
Tuite, P.T., *See* Berlin, R.E., 9:49544
Tulinov, A.F., *See* Eremin, N.V., 9:50854, 9:50855
See Kadmenskij, A.G., 9:50947
Tuplin, T.A., Contamination surveys of plant room and roof-void in B. 154 at the National Physical Laboratory, Teddington, 9:50362 (R;GB)
Final report on contamination surveys at NPL, 9:50361 (R;GB)
Turhollow, A.F. Jr., *See* Perlack, R.D., 9:49599
Turkot, F., *See* Hirsch, A.S., 9:50868
Turner, J.E., Radiation, chemicals, and occupational health research, 9:50605 (R;US)
See Hamm, R.N., 9:50926
Turner, L.R., Computer simulation of multiple stability regions in an internally cooled superconducting conductor and of helium replenishment in a bath-cooled conductor, 9:51031 (R;US)
Turner, M., *See* Steinke, R., 9:49886
Turner, T.F., Investigation of tracer tests on the Western Research Institute 10-ton retort, 9:49496 (R;US)

Turnik, S., *See* Chvalova, J., 9:49774
Tvedt, T.J., *See* Swan, F.E. Jr, 9:49771
Twardoch, U.M., *See* White, S.H., 9:50332
Tye, C., *See* Hauserman, W.B., 9:49381
Tyree, C.D., Cost analysis of proposed changes to 40 CFR (Code of Federal Regulations) Part 600 to improve fuel economy labeling and the fuel economy data base. Technical report, 9:50017 (R;US)
History and description of the EPA (Environmental Protection Agency) motor vehicle fuel economy program. Technical report, 9:50015 (R;US)

U

Udagawa, T., *See* Lenske, H., 9:50857
Ufukov, P.P., *See* Bagaev, V.N., 9:50742
Ugozzoni, A., *See* Fuschini, E., 9:50125
Ulbricht, J., Tensor polarisation t_{20} in pion-deuteron elastic scattering, 9:50832 (RA;AU)
Ulrich, W.C., *See* Salmon, R., 9:49373
Unger, H., *See* Chillingworth, R.S., 9:49372
Urban, M., Dose estimation by simultaneous measurement of the radon/thoron concentration and the equilibrium factors in air using a passive dosemeter, 9:50480 (R;DE;In German)
Urbantke, H., Algebra of two-component spinors. A revision, 9:50981 (R;AT;In German)
Urmanov, A.P., *See* Burenkov, A.F., 9:50124
Urmanov, A.R., *See* Bagaev, V.N., 9:50742
Usoro, P.B., Methodology for power system emergency state control, 9:49743 (R;US)
Uzunov, I., Non-sampling gamma-spectrometric analysis of IRT-2000 reactor coolant, 9:49826 (RA;BG;In Bulgarian)

V

Vaclavik, J., *See* Kritz, A.H., 9:50989
Valentine, K.H., Recent developments in position-sensitive neutron counting, 9:50490 (BA;GB)
Valeo, E., *See* Motley, R., 9:50999
Vallabhan, C.V.G., A computer model for stress analysis of spherically curved solar panels, 9:49708 (BA;US)
Vallet, C.E., Photoacoustic spectroscopy at electrode-solution interface, 9:50329 (R;US)
Vamberskii, I.V., Thermodynamic properties of gamma-uranium in the formation of solid solutions with alpha-transition metals, 9:50150 (TG;US)
Van Curen, J., Calorimetric investigation into the possibility of a charge density wave ground state in alkali metals, 9:50133 (R;US)
van der Kraan, A.M., *See* Gubbens, P.C.M., 9:50751
Van Der Leeden, G.A., *See* Young, R.T., 9:49636
Van Dyke, J., *See* Corum, K.R., 9:50027
Van Grieken, R., *See* Gijbels, R., 9:49724
Van Hoesen, S.D., *See* Klein, J.A., 9:49404
Van Hook, A.R., Medium speed computer interface (digitizer) for general purpose data acquisition, 9:50503 (R;US)
Van Hove, M.A., Structure determination of molecular adsorbates with dynamical LEED and HREELS, 9:50745 (R;US)
Van Hulst, K., *See* Marston, P.G., 9:51041
van Lier, J.J.C., Survey of research work on injection cooling at Delft Technical University, 9:49751 (TJ;GB)
van Paassen, C.A.A., *See* van Lier, J.J.C., 9:49751
Van Riper, K.A., Neutron star cooling: effects of envelope physics, 9:50712 (BA;NL)
Van't Dack, L., *See* Gijbels, R., 9:49724
Van Tuyle, G.J., MINET simulation of a helical coil sodium/water steam generator, including structural effects, 9:49892 (R;US)
MINET validation study using steam generator transient data, 9:49893 (R;US)
Vandelannoote, R., *See* Gijbels, R., 9:49724
Vanderborgh, N.E., *See* Elliott, G.R.B., 9:49483
Vane, C.R., *See* Rosseel, T.M., 9:50149
Vanecek, D.L., High voltage variable diameter insulator, 9:50209 (P;US)
Vanka, S.P., Accuracy of the finite analytic method for scalar transport calculations, 9:51048 (R;US)
Varady, W.A., *See* Safinya, C.R., 9:50320
Vasil'ev, V.K., Energy-dispersion X-ray analysis for investigation of structural transformations in crystals at ion implantation, 9:50126 (RA;SU;In Russian)
Vaughn, J.M., Virus entrainment in a glacial aquifer, 9:50566 (R;US)
Velkov, K., Fixed in-core detector reading analysis, 9:49776 (RA;BG;In Bulgarian)
See Kolev, N., 9:49799, 9:49825
See Uzunov, I., 9:49826
Venturini, E.L., *See* Bowman, R.C. Jr., 9:50163
Verderber, R.R., Lighting controls: the role of advanced technology - past, present, and future, 9:49995 (R;US)
New lighting technologies, their status and impacts on power densities, 9:49997 (R;US)
Verfondern, K., *See* Jahn, W., 9:49861
Verhoeven, J.D., *See* Sue, J.J., 9:50386
Verhoff, F.H., Sour water stripping of coal gasification waste water. Final report, 9:49386 (R;US)
Vermeer, W.J., Coulomb excitation of the nucleus ^{7}Li, 9:50841 (RA;AU)
See Burnett, M., 9:50874
Vershinin, G.A., *See* Adeev, G.D., 9:50736
Versteeg, H.K., Slurry pipeline cost analysis computer program, 9:49418 (R;GB)
Verville, G., Rapid electrolyte exchange procedures for 22 AH Nickel-Cadmium Celgard cells, 9:49911 (R;CA)
Veselinov, G., Class of solutions of the Einstein's equations. Solutions of the equations of the geodesics, 9:50961 (RA;BG;In Bulgarian)
Solutions of the cosmological equations with cylindrical symmetry in space parts of the metrical interval, 9:50960 (RA;BG;In Bulgarian)
Vetter, U.R., Seismological investigations of volcanic and tectonic processes in the Western Great Basin, Nevada and Eastern California, 9:49727 (BA;US)
Villiers-Fisher, J.F., Evaluation of two conceptual wastewater treatment schemes for a Lurgi-based indirect coal liquefaction plant, 9:49360 (R;US)
Vilquin, A., *See* Langlois, J., 9:50603
Vineyard, T.A., *See* Bircher, C., 9:49690
Vitek, J.M., *See* David, S.A., 9:50104
Vitek, V., Atomistic studies of grain boundaries with segregated impurities. Final progress report, July 1983-June 30, 1984, 9:50108 (R;US)
Vlaskamp, L., Radioactive materials decree and the radiation apparatus decree in the nuclear energy law, 9:49931 (RA;NL;In Dutch)
Vo-Dinh, T., Instrumentation for occupational health research, 9:50494 (R;US)
Voecks, G.E., *See* Won, Y.S., 9:49666
Voelz, G.L., Studies of plutonium workers, 9:50622 (J;US)
Vogt, E.W., Pions and muons - beyond exotic atoms, 9:50731 (RA;AU)
Voigt, K., Compilation of data sources for existing chemicals, 9:50635 (R;DE)
Vojkov, G., *See* Khristov, V., 9:50930
von Molnar, S., *See* Wong, P.Z., 9:50942
Vorres, K.S., Premium Coal Sample Program: a model, 9:49376 (R;US)
Voss, H.J., Development of a melting apparatus for lithium-containig magnesium-aluminium alloys and its application in thermal analysis, 9:50135 (R;DE;In German)

W

Waddoups, I.G., *See* Reuters, H., 9:49570
Wagner, A., *See* Gindele, K., 9:49620
Wagner, B.S., Comparisons of predicted and measured energy use in occupied buildings, 9:49994 (R;US)
Wagner, J., Development of particle-sizing for high concentrated colloidal dispersions based on photon correlations spectroscopy, 9:50296 (R;DE;In German)
Wagner, J.E., *See* Bowman, R.C. Jr., 9:50163
Wagner, R., Model investigations about flow in industrial halls with heat sources, 9:50405 (R;DE;In German)
Wagner, W., *See* Berger, C., 9:50767
Wahle, H.W., *See* Burgess, V.E., 9:50054
Wakefield, R.A., Study of pipeline applications of fuel cells. Final report, 9:49961 (R;US)
Walker, R.J., *See* Hodge, G.A., 9:50467
See Luhmann, J.G., 9:50716
Walker, R.M., *See* Foote, J.H., 9:50680

Wallace, W., Progress in the SERI-DOE Photoelectrochemical Cell Program, 9:49642 (BA;US)
Wallin, T., *See* Liem, H., 9:49398
Walsh, R., *See* Borden, P.G., 9:49638
Walsh, R.L., Measurement of subthreshold fission cross section in ^{230}Th(n,f), 9:50904 (RA;AU)
Wang, C.C., Comments on laser-excited fluorescence of the hydroxyl radical: relaxation coefficients at atmospheric pressure, appendix 5, 9:50748 (R;US)
See Bakalyar, D.M., 9:50513
Wang, C.Y., Coefficients determination of differential state equations from Laplace transfer function, 9:51052 (R;TW;CH)
Solving of inverse Z-transfer function by recurrent permutation method, 9:50978 (R;TW)
Wangen, L.E., Attenuation of chemical elements in acidic leachates from coal mineral wastes by soils, 9:49407 (R;US)
Wannamaker, P.E., Resistivity structure of the Northern Basin and Range, 9:49726 (BA;US)
Ward, B., *See* Hanson, L.K., 9:50337
Ward, R.A., *See* Mathews, G.J., 9:50703
Ward, S.H., Geophysical studies of active geothermal systems in the Northern Basin and Range, 9:49725 (BA;US)
Warpinski, N.R., *See* Teufel, L.W., 9:49476
Wastell, J.M.R., ^{40}Ca(p,pd)^{39}K and ^{40}Ca(p,2p)^{39}K reactions at 150 MeV, 9:50862 (RA;AU)
Waterhouse, R., *See* Jalan, V., 9:49338
Watson, C.R., *See* Olsen, A.R., 9:50019, 9:50020, 9:50021, 9:50022
Watson, J.S., Solid wastes from coal and shale: projections of waste forms and utilization potential, 9:49384 (R;US)
See Boegly, W.J. Jr., 9:49399
See Tanase, M., 9:50310
Watson, R.D., *See* Edmonds, P.H., 9:51027
Watters, R.L., *See* Dagle, G.E., 9:50621
Watts, R.L., *See* Levine, L.O., 9:50061
Waymouth, R.M., Trigonal-bipyramidal methyl group bridging two zirconocene-ketene centers, 9:50307 (J;US)
Weaver, H.T., High efficiency silicon solar cells, 9:49634 (BA;US)
Weber, G.F., SO/sub x//NO/sub x/ control, 9:49752 (RA;US)
Weber, R.O., Proton induced reactions on ^{37}Cl and their relevance to nucleosynthesis, 9:50853 (RA;AU)
Weiner, J.S., Subnanosecond time-resolved emission study of Cu_2O and GaAs, 9:50203 (R;US)
Time-resolved resonant Raman scattering and hot luminescence at the 1S ortho-exciton in Cu_2O, 9:50747 (R;US)
Weinert, M., *See* Ohnishi, S., 9:50142
Weise, L., *See* Borchardt, G., 9:49837
Weiss, E., New fabrication techniques for components-fabrication demands and in-service reliability, 9:49810 (RA;DE;In German)
Weisser, D.C., *See* Drumm, P.V., 9:50839
See Fifield, L.K., 9:50851
See Hotchkiss, M.A.C., 9:50860
Weisz, P., Definition and general properties of the transfer matrix in continuum limit improved lattice gauge theories, 9:50802 (R;DE)
Weizer, V.G., Voltage controlling mechanisms in low resistivity silicon solar cells: a unified approach, 9:49613 (R;US)
Wendrinsky, J., *See* Schaudy, R., 9:50347, 9:50348
Wenzelburger, H., *See* Nagel, K., 9:49520
Weres, O, Downhole sampling of geopressured gas wells. Final report, June 1982-July 1984, 9:49477 (R;US)
Werner, J., *See* Breunlich, W.H., 9:50752
Werthen, J.G., 10 percent efficient ITO-CdTe heterojunction solar cell, 9:49647 (BA;US)
West, D.C., *See* Solomon, A.M., 9:50547
Westerman, B., Radiological work in a university centre. Occupational health problems, 9:50938 (RA;NL;In Dutch)
Westfall, R.M., *See* Dodds, H.L. Jr., 9:49801
Westhoff, J., *See* Paciorek, K.L., 9:49506
Wexler, J., Use of furnace curtains to reduce energy consumption in glass annealing furnaces, 9:50055 (R;US)
Wezulek, R., *See* Frevert, E., 9:49573
Whang, Y.C., Coalescence of two pressure waves associated with stream interactions, 9:50689 (R;US)
Wheatcraft, S.W., *See* Hess, J.W., 9:50573
Wheeler, K.R., Aluminum alloy performance in industrial air-cooled applications, 9:50156 (J;US)
White, C.L., *See* Liu, C.T., 9:50106
White, C.W., Formation of amorphous layers in Al_2O_3 by ion implantation, 9:50157 (R;US)
See Zehner, D.M., 9:50239
White, J.C., *See* Sharma, D.K., 9:49747
White, J.T., *See* Reichert, J.D., 9:49713
White, S.H., The behavior of water in molten salts, 9:50332 (J;US)
Whiting, M.A., *See* Carr, D.B., 9:51060
See Nicholson, W.L., 9:51059
Whittingham, I.B., *See* Hicks, G., 9:50873
Wickstrom, G.V., *See* Clifford, M.J., 9:50029
Wiegner, W., *See* Decman, D.J., 9:50897
Wiese, J.D., Outer Continental Shelf oil and gas activities in the Gulf of Alaska and their onshore impacts. Gulf of Alaska summary report update, May 1984, 9:49449 (R;US)
Wilk, B.H., Detectors for quark and gluon jets at high energies, 9:50762 (R;DE)
Wilder, J.A. Jr., *See* Day, D.E., 9:50211
Wiley, R., *See* Steinke, R., 9:49886
Wilgen, J.B., *See* Casson, W.H., 9:51002
Wilhelm, J., *See* Ruedinger, V., 9:49869
Wilkins, M.A., *See* Ivanovich, M., 9:49530
Wilkins, S.C., Binary thermoelectric level detector, 9:50497 (R;US)
Wilkinson, D.T., Microwave and theoretical studies for Cosmic Background Explorer satellite, 9:50702 (R;US)
Willard, D.H., *See* Ballou, J.E., 9:50620
Williams, A.G., Soliton bags in quantum field theory, 9:50805 (RA;AU)
Williams, G.P., *See* Rothberg, G.M., 9:50304
Williams, J.D., *See* Boegly, W.J. Jr., 9:49541
Williams, J.M., Ion implantation of surgical Ti-6Al-4V alloy, 9:50590 (R;US)
See Beno, M.A., 9:50315
See McHargue, C.J., 9:50160
Williams, J.S., Applications of channeling in ion beam analysis of crystals, 9:50190 (RA;AU)
See Brown, R.A., 9:50284
See McCallum, J.C., 9:50283
See Rossiter, K.G., 9:50192
See Short, K.T., 9:50191
Williams, M.D., *See* Ford, A., 9:49757
See Nochumson, D.H., 9:50534
Williams, M.V., Segmenting markets for conservation, 9:50047 (RA;US)
Williams, M.W., Arc-evaporated carbon films: optical properties and electron mean free paths, 9:50183 (R;US)
Willis, A., *See* Hane, G.J., 9:49943
Wilson, D.J., Microscopic determination of ^{10}B for boron neutron capture therapy of malignant melanoma, 9:50279 (RA;AU)
Wilson, G.H. III, *See* Nemzek, T.A., 9:49933
Wilson, H.W., Scottish Universities Research and Reactor Centre, East Kilbride. Report on session 1982-1983, 9:49840 (R;GB)
Wilson, K.L., *See* Roth, J., 9:50718
Wilson, L.G., *See* Everett, L.G., 9:50553
Wilson, R.M., A comparative look at sunspot cycles, 9:50697 (R;US)
Wilson, S.R., Isothermal annealing of ion implanted silicon with a graphite radiation source, 9:50237 (BA;NL)
Wilson, T.J., *See* Coates, C.W., 9:50148
Winhold, M., *See* Tsatsaronis, G., 9:50431
Winkelhofer, W., *See* Knotik, K., 9:50057
Winn, M.M., Composition of cosmic radiation for energies of more than 100 TeV, 9:50671 (RA;AU)
Witiak, D.T., Chemical and molecular biological aspects of alkylhydrazine-induced carcinogenesis in human cells in vitro. Revised. Final report 1 July 1980-30 September 1983, 9:50628 (R;US)
Witte, W., *See* Forch, K., 9:50119
Wittenberg, L.J., Interface movement in salt-gradient solar ponds, 9:49711 (BA;US)
Wittenberg, N., *See* Peirce, J.J., 9:50430
Wolf, A.P., *See* Shiue, C.Y., 9:50355
Wolf, G.A., Method for incorporating radioactive phosphoric acid solutions in concrete, 9:50216 (P;US)
Wolf, I., *See* Bechtold, W.E., 9:50640
Wolff, P.A., Infrared nonlinear processes in semiconductors. Final technical report 1 October 1979-30 November 1983, 9:50389 (R;US)
Woloch, F., *See* Kamelander, G., 9:49895
Wolter, H.H., *See* Lenske, H., 9:50857
Won, Y.S., Experimental and theoretical study of a solar thermochemical receiver module, 9:49666 (R;US)
Wong, C.P.C., *See* McCarville, T.J., 9:51036
Wong, K.V., *See* Gerrish, H.P., 9:49581
Wong, P., Observation of a disordered spin-flop phase in Fe/sub 0.725/Co/sub 0.275/Cl_2, 9:50308 (J;US)
Wong, P.Z., Experimental studies of random-field effects in uniaxial random antiferromagnets, 9:50942 (R;US)
Wong, S., Imploding plasma x-ray laser research. Draft final report, 9:50394 (R;US)

Woo, H.H., *See* Lo, T.Y., 9:49890
Wood, L., *See* Stuchbery, A.E., 9:50889
Wood, R.A., *See* Neal, R.W., 9:49686
Wood, R.F., Modified laser-annealing process for improving the quality of electrical P-N junctions and devices, 9:50427 (P;US)
Wood, T.J., *See* Klein, J.A., 9:49404
Woodruff, K.H., Delayed sequelae of pituitary irradiation, 9:50626 (J;US)
Woods, C.L., Shell-model description of narrow, highly-excited states in ^{9}Be, 9:50835 (RA;AU)
See Drumm, P.V., 9:50839
See Fifield, L.K., 9:50851
See Hotchkiss, M.A.C., 9:50860
Wookey, C.W., Charge monitoring in an external proton beam, 9:50274 (RA;AU)
Woolcock, W.S., *See* Jaus, W., 9:50829
Woolf, S., *See* Filippone, W.L., 9:50933
Wooton, R.O., MARCH 2 (Meltdown Accident Response Characteristics) code description and user's manual, 9:49894 (R;US)
Wrenn, G.E. Jr., Method for depositing a uniform layer of particulate material on the surface of an article having interconnected porosity, 9:50215 (P;US)
Wright, H.A., *See* Hamm, R.N., 9:50926
Wright, M.H., *See* Gill, P.E., 9:51062
Wright, M.K., *See* Nuckovich, M., 9:50426
Wright, S., Conservation in a load/resource planning and analysis process, 9:50046 (RA;US)
Wrulich, A., RACETRACK - a computer code for the simulation of nonlinear particle motion in accelerators, 9:50452 (R;DE)
Wu, E.S., *See* Fowkes, W.R., 9:50464
Wu, I.W., Critical current density of bronze-processed multifilamentary Nb_3Sn wires with magnesium addition to the matrix, 9:50141 (J;US)
Wu, S.J., Sub-eutectic densification and second phase formation in Al_2O_3 - CaO, 9:50162 (R;US)
Wu, T.T., *See* Berends, F.A., 9:50772, 9:50773
Wu, X., Fermion zero modes on parallelized and squashed group manifolds, 9:50811 (J;US)
Wuebbles, D.J., Proposed reference set of scenarios for radiatively active atmospheric constituents, 9:50526 (R;US)
Wunderle, J.A., Combustion efficiency optimization manual for operators of oil- and gas-fired boilers. Final report, 9:50433 (R;US)
Wurtinger, W., *See* Thomas, W., 9:49793

X

Xiaoen, L., Method to estimate the vertical dispersion parameter in a 10 Km range, 9:50514 (R;US)
Xinyuan, J., *See* Xiaoen, L., 9:50514
Xuan, P.T., *See* Jones, G. II, 9:50345

Y

Yadoya, R., *See* Camara, A.S., 9:49510
Yamada, H., Localized l window from partial fusion reactions accompanied by proton, deuteron, and triton emission, 9:50887 (RA;AU)
Partial fusion reaction and its application to high-spin spectroscopy, 9:50890 (RA;AU)
Yamagishi, H., Magnetic monopoles and fractional Witten indices, 9:50798 (J;US)
Yamamoto, T., Study of the current drive by the lower hybrid wave in a tokamak, 9:50996 (RA;GB)
See Rinard, G., 9:49755
Yamazaki, K., *See* Mitter, H., 9:50971, 9:50972
Yamazaki, O., Wide-range, high-efficiency control system for the refrigeration cycle, 9:50025 (TJ;US)
Yaniv, S., *See* Chern, I.L., 9:50398
Yao, N.P., *See* Minh, N.G., 9:50333
Yarlagadda, B.S., *See* Khalil, H., 9:49849
Yatis, A.A., *See* Zavodchikov, V.M., 9:50737
Yavoraky, P.M., *See* Rogers, S.E., 9:49374
Yildiz, A., Hypercolor unification without cosmological domains, 9:50812 (J;US)
Yoo, M.H., SANS and TEM studies of carbide precipitation and creep damage in type 304 stainless steel, 9:50103 (R;US)
York, R.L., Development of a high current H^- injector for the proton storage ring at LAMPF, 9:50463 (R;US)
Young, B., *See* Wong, S., 9:50394
Young, C., Fracture control blasting techniques for oil shale mining, 9:49495 (BA;US)
Young, G.R., Accelerator-colliders for relativistic heavy ions or in search of luminosity, 9:50444 (R;US)
10-GeV heavy-ion collider, 9:50443 (R;US)
Near-threshold production of neutral π mesons in heavy-ion reactions, 9:50848 (R;US)
Young, J.L., *See* Marston, P.G., 9:51041
Young, J.P., *See* Rosseel, T.M., 9:50149
Young, P.G., Analysis of n + ^{197}Au cross sections for E/sub n/ = 0.01-20 MeV, 9:50902 (R;US)
Young, R.T., Studies of grain boundaries in small-grained polycrystalline silicon solar cells, 9:49636 (BA;US)
See Narayan, J., 9:50240
See Wood, R.F., 9:50427
Young, T., Effects of electromagnetic fields produced by high voltage transmission lines. Final report, 9:50652 (R;US)
Yount, J.A., Conceptual design report for a remotely operated cask handling system. Revision 1, 9:50367 (R;US)
Yu, P.Y., *See* Weiner, J.S., 9:50747
Yuen, S.Y., *See* Wolff, P.A., 9:50389
Yuminov, O.A., *See* Eremin, N.V., 9:50855
Yung, S., *See* Jain, R., 9:49392
Yung, S.C., Performance of gas-atomized spray scrubbers at high pressure, 9:49402 (J;US)
Yust, C.S., *See* McHargue, C.J., 9:50159
Yutani, N., *See* Song, J.C., 9:50435

Z

Zabaev, V.N., *See* Denisov, F.P., 9:50951
Zagel, J., *See* Theilacker, J., 9:50470
Zahradka, L., *See* Prokop, K., 9:49818
Zakharov, A.V., *See* Pissarenko, N.F., 9:50683
Zakowicz, W., Proton laser accelerator by means of the inverse free electron laser mechanism, 9:50442 (R;US)
Zamir, D., *See* Raizman, A., 9:50113
Zanella, A.W., *See* Mok, C.Y., 9:50336
Zantopp, D., *See* Sondericker, J.H., 9:50472
Zaremski, D.R. Jr., Automated installation methods for photovoltaic Arrays II, 9:49624 (R;US)
Zavodchikov, V.M., Internal monitor in Rutherford scattering, 9:50737 (RA;SU;In Russian)
Zawadowski, A., *See* Tua, P.F., 9:50212
Zbasnik, J.P., *See* Hoard, R.W., 9:51042
Zee, A., Gravity as a dynamical consequence of the strong, weak, and electromagnetic interactions, 9:50977 (BA;US)
Zehner, D.M., Surface studies of laser annealed semiconductors, 9:50239 (BA;NL)
Zehr, F.J., Characterization of representative air and liquid-type collectors for solar economic analysis in residences, 9:49698 (BA;US)
House thermal envelope conservation optimization with respect to performance/economics, 9:49968 (R;US)
Zellama, K., *See* Germain, P.J., 9:50245
Zeng, L.W., *See* Shana, J.Yu., 9:49497
Zenz, F.A., *See* Lippert, T.E., 9:49389
Zhukova, Yu.N., Angular dependence of helium ion energy losses in gold, 9:50931 (RA;SU;In Russian)
Zillessen, C., Technical equipment for rescuing injured miners in case of roof breaks in coal faces and roadways, 9:49439 (R;DE;In German)
Zimmer, E., *See* Merz, E., 9:49518
Zimmerman, D.E., *See* Hess, J.W., 9:50573
Zimmermann, C., Energy transformation during dynamic crack initiation and arrest, 9:50121 (RA;DE;In German)
Zingg, S.P., Reactivity of anthracene in liquid $SbCl_5$-$AlCl_3$-N-(1-BUTYL)pyridinium chloride mixtures, 9:50327 (J;US)
Zinner, E.K., *See* Foote, J.H., 9:50680
Zmeskal, A.J., *See* Breunlich, W.H., 9:50752
Zorabedian, P., Beam shaping for CW laser recrystallization of polysilicon films, 9:50224 (BA;NL)
Zubanov, D., ^{17}O(γ,p) cross section, 9:50843 (RA;AU)
Zucchini, G.L., *See* Rosenow, M.K., 9:50597
Zumino, B., Supersymmetry and supergravity, 9:50799 (J;NL)
Zurek, W.H., Reduction of the wavepacket: how long does it take, 9:50967 (R;US)

SUBJECT INDEX

The subject index is based on the use of subject descriptors selected from a controlled thesaurus of terms (DOE/TIC-7000). Subject descriptors and qualifiers (subheadings) are selected and presented in the following format:

SUBJECT DESCRIPTOR
Qualifier
Title, (supplementary information), citation number, (R;US)

The notations in the final parentheses indicate the type of document, e.g., R for Report; the country of publication, e.g., US; and the language if other than English, e.g., In German. Tables of document types and country of publication codes appear after the indexes.

The title may be supplemented with additional words, or a phrase, if it appears additional information would be helpful. In cases for which the title contains little or no information related to the subject entry, it may be replaced entirely by the supplementary information. A qualifier is not always required, and in such cases the title will follow the unqualified subject descriptor.

The descriptors selected for use as subject terms are generally the names of specific materials, things, or processes. To the extent possible, a qualifier is selected to describe the properties of, or processes applied to, the subject term.

Index entries are selected to indicate the important ideas and concepts presented in a document, rather than words that may appear in the text. Within the available thesaurus terms, the most probable or logical place to look for typical information is selected. "See references" are included to guide users from synonymous terms or phrases to the descriptor selected as a subject heading for the concept. (e.g. Pipeline Quality Gas see HIGH BTU GAS). "See also references" are used to indicate where to find references to subject concepts that are narrower, broader, or related to a particular subject heading. To complete an exhaustive search of a given subject, all such headings should be reviewed. Copies of DOE/TIC-7000, the Subject Thesaurus, are available from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, VA 22161.

A

ABANDONED SITES
Fires
Calamity Hollow Mine Fire Project. 3. Instrumentation for combustion monitoring, process control, and data recording. Report of investigations/1984, 9:49415 (R;US)
Remedial Action
Remedial action at the Acid/Pueblo Canyon site, Los Alamos, New Mexico. Final report, 9:49567 (R;US)

ABANDONED WELLS
Geophysical Surveys
Geophysical methods for locating abandoned wells, 9:50664 (R;US)

A-BOMB SURVIVORS
Delayed Radiation Effects
Delayed immunologic effects of low dose radiation in Japanese A-bomb survivors. Technical progress report, 9:50609 (R;US)

ABSORBED DOSES
See RADIATION DOSES

ABSORBERS (SOLAR)
See SOLAR ABSORBERS

ACCELERATOR FACILITIES
See also STANFORD LINEAR COLLIDER
Research Programs
High energy physics facilities. Hearing before the Subcommittee on Energy Development and Applications of the Committee on Science and Technology, US House of Representatives, Ninety-Eighth Congress, First Session, October 19, 1983, 9:50761 (B;US)

ACCELERATORS
See also COHERENT ACCELERATORS
COLLECTIVE ACCELERATORS
HEAVY ION ACCELERATORS
LINEAR ACCELERATORS
Particle Tracks
RACETRACK - a computer code for the simulation of nonlinear particle motion in accelerators, 9:50452 (R;DE)
Superconducting Magnets
Automation of a cryogenic facility by commercial process control computer, 9:50472 (BA;US)

ACCIDENTAL IRRADIATION
See RADIATION ACCIDENTS

ACES
See QUARKS

ACETYLENE
Adsorption Isotherms
Separation factor method for the analysis of ideal binary mixtures in gas-solid adsorption, 9:50293 (J;US)
Pyrolysis
Carbon particles, 9:50214 (P;US)
Separation Processes
Separation factor method for the analysis of ideal binary mixtures in gas-solid adsorption, 9:50293 (J;US)

ACID ELECTROLYTE FUEL CELLS
Fabrication
Phosphoric acid electric utility fuel cell technology development. Technical progress report No. 13, 9:49962 (R;US)
Performance Testing
Phosphoric acid electric utility fuel cell technology development. Technical progress report No. 13, 9:49962 (R;US)

ACID RAIN
Air Pollution Control
Acid rain control (Part 2). Hearings before the Subcommittee on Health and the Environment of the Committee on Energy and Commerce, House of Representatives, Ninety-Eighth Congress, Second Session on H.R. 3400, February 17 and March 5, 1984, 9:50544 (B;US)
Political Aspects
Comments on acid rain, 9:50537 (BA;US)

ACO
Free Electron Lasers
Experimental investigation of the characteristics of an ultraviolet storage ring laser, 9:50475 (R;US)

ACOUSTIC MONITORING
Frequency Analysis
Spectral analyzer of vibroacoustic signals, 9:49818 (RA;CS;In Czech)
On-Line Measurement Systems
Vibroacoustic diagnostic system, 9:50412 (RA;CS;In Czech)

ACRIFLAVINE
Fluorescence
Concerning the question of the fluorescence yield of solutions, 9:50328 (TJ;US)

ACTINIDE COMPOUNDS
Physical Properties
Actinides: from heavy fermions to plutonium metallurgy, 9:50132 (R;US)

Thermodynamic Properties
Enthalpy of formation of americium sesquioxide; systematics of actinide sesquioxide thermochemistry, 9:50297 (R;US)

ACTINIDES
See also AMERICIUM
CURIUM
FERMIUM
NOBELIUM
PLUTONIUM
THORIUM
URANIUM
Electronic Structure
Actinides: from heavy fermions to plutonium metallurgy, 9:50132 (R;US)

ACTIVATED CARBON
Regeneration
Supercritical solvent extraction, 9:49334 (RA;US)
Sorptive Properties
Separation factor method for the analysis of ideal binary mixtures in gas-solid adsorption, 9:50293 (J;US)

ACTIVATED SLUDGE PROCESS
Energy Demand
Thermal treatment of municipal sewage sludges, 9:50551 (R;US)
Health Hazards
Thermal treatment of municipal sewage sludges, 9:50551 (R;US)

ACTIVATION ANALYSIS
Current techniques in neutron activation analysis, 9:50278 (RA;AU)
Trace element determination in biological materials by neutron activation analysis, 9:50268 (RA;CS;In Czech)
Computer Codes
Use of computers in neutron activation analysis, 9:50273 (RA;AU)
Meetings
Microelements '80. Conference proceedings, 9:50267 (R;CS;In Czech and Slovak)

ADENOMAS
Radiotherapy
Delayed sequelae of pituitary irradiation, 9:50626 (J;US)

ADHESIVES
Chemical Composition
Self-contained exothermic applicator and process, 9:50384 (P;US)
Ignition
Self-contained exothermic applicator and process, 9:50384 (P;US)

ADSORBENTS
See also ACTIVATED CARBON
Regeneration
Metal/metal oxides as high temperature desulfurization sorbents, 9:49338 (RA;US)

ADSORPTION ISOTHERMS
Gasification wastewater treatment and reuse (Hydantoins on activated carbon), 9:49331 (RA;US)

AEROSOL GENERATORS
Design
Effects of air pollutants on plant cell tissue cultures (Tobacco, rose soybean, periwinkle, and morning glory), 9:50651 (B;US)

AEROSOLS
See also RADIOACTIVE AEROSOLS
SMOKES
Filters
Response of HEPA filters to high differential pressures, 9:49869 (RA;DE;In German)
Radiation Monitoring
Results and conclusions from the radiation monitoring around the IRT-2000 nuclear reactor in Sofia for the 1962-1982 period, 9:49828 (RA;BG;In Bulgarian)

AGRICULTURAL RESIDUES
See AGRICULTURAL WASTES

AGRICULTURAL WASTES
See also MANURES
Anaerobic Digestion
Evaluation of energy from the biomass of agricultural origin: a review of the achievements in France and Italy. Series fast No. 15, 9:49591 (R;LU;In French)
Combustion
Evaluation of energy from the biomass of agricultural origin: a review of the achievements in France and Italy. Series fast No. 15, 9:49591 (R;LU;In French)

AIR
See also SURFACE AIR
Nuclear Reaction Analysis
Charge monitoring in an external proton beam, 9:50274 (RA;AU)
Photon Transport
SKYSHINE-P: a point kernel computer program for calculating SKYSHINE exposure rates, 9:50929 (R;TW;CH)
PIXE Analysis
Charge monitoring in an external proton beam, 9:50274 (RA;AU)

AIR FLOW
Flow Regulators
Air-flow regulation system for a coal gasifier, 9:49365 (P;US)

AIR POLLUTION
See also INDOOR AIR POLLUTION
Atmospheric Chemistry
Proposed reference set of scenarios for radiatively active atmospheric constituents, 9:50526 (R;US)
Biological Effects
Mortality and air pollution: lessons from statistics, 9:50647 (J;NL)
Biological Indicators
Air quality monitoring at Sullom Voe using lichens as biological indicator species: results of the 1981 and 1982 repeat photographic surveys, 9:49466 (R;GB)
Ecological Concentration
Proposed reference set of scenarios for radiatively active atmospheric constituents, 9:50526 (R;US)
Environmental Effects
Oxidation-sulfidation behavior of materials in coal-conversion environments, 9:50152 (J;JP)
Environmental Impacts
Effects of solid fuel fired plants for district heating. Air quality studies in two towns, 9:49406 (R;SE;In Swedish)
Meetings
Health and Environmental Risk Analysis Program workshop: potential public health impacts of airborne organic combustion products, 9:50521 (R;US)
Monitoring
Size distribution of airborne particulate matter emitted by the front-end processing of municipal solid waste feed material for large-scale anaerobic digesters, 9:49581 (J;US)
Particulates
Influence of particles in diesel engine exhaust gas during cooling and mixing with the surrounding air, 9:50080 (R;DE;In German)

AIR POLLUTION CONTROL
Use this term for items that involve the removal or management of pollutants after they are formed by a source.
Economic Impact
Acid rain control (Part 2). Hearings before the Subcommittee on Health and the Environment of the Committee on Energy and Commerce, House of Representatives, Ninety-Eighth Congress, Second Session on H.R. 3400, February 17 and March 5, 1984, 9:50544 (B;US)
Legislation
Acid rain control (Part 2). Hearings before the Subcommittee on Health and the Environment of the Committee on Energy and Commerce, House of Representatives, Ninety-Eighth Congress, Second Session on H.R. 3400, February 17 and March 5, 1984, 9:50544 (B;US)
Trajectories
Some statistical distributions of air particle trajectories near the ground in Finland, 9:50529 (R;FI;In Finnish)

AIR QUALITY
Mathematical Models
Regional air quality model assessment and evaluation. Final report, 9:50528 (R;US)

AIR SAMPLERS
Design
Use of a massive volume air sampler to collect fly ash for biological characterization, 9:50535 (J;US)
Operation
Use of a massive volume air sampler to collect fly ash for biological characterization, 9:50535 (J;US)
AIR SOURCE HEAT PUMPS
Control
Air heat source heat pump chiller with a new refrigerant flow rate control, 9:50026 (TJ;US)
Refrigerants
Air heat source heat pump chiller with a new refrigerant flow rate control, 9:50026 (TJ;US)
AIRBORNE PARTICLES
See PARTICULATES
AIRBORNE PARTICULATES
See PARTICULATES
AIRCRAFT FUELS
See AVIATION FUELS
AIRCRAFT PROPULSION REACTORS
Physical Radiation Effects
System 125A: preliminary radiation effects analysis, (Tarpon) experimental airplane, 9:49843 (R;US)
ALAP
See RADIATION PROTECTION
ALASKA
Natural Gas Distribution Systems
Alaska Natural Gas Transportation System, 9:49485 (R;US)
ALCATOR DEVICE
Current-Drive Heating
Computational model for lower hybrid current drive, 9:50991 (RA;GB)
Lower hybrid current drive experiments on the Alcator C and the Versator II tokamaks, 9:50997 (RA;GB)
ALDEHYDO ACIDS
See CARBOXYLIC ACIDS
ALFVEN WAVES
Kinetic Equations
Shear-Alfven dynamics of toroidally confined plasmas. Part B, 9:51006 (R;US)
Shear-Alfven dynamics of toroidally confined plasmas. Part A, 9:51005 (R;US)
ALKALI METAL COMPOUNDS
Catalytic Effects
Catalytic coal gasification, 9:49359 (R;GB)
ALKALI METALS
See also CESIUM
LITHIUM
POTASSIUM
RUBIDIUM
SODIUM
Chemical Reactions
Chemical effects of entrained particles in coal conversion streams: prediction of PFBC alkali levels, 9:49432 (RA;US)
Evaporation
Chemical effects of entrained particles in coal conversion streams: prediction of PFBC alkali levels, 9:49432 (RA;US)
Recovery
Recovery of alkali metal constituents from catalytic coal conversion residues, 9:49363 (P;US)
Removal
High-temperature moving bed granular filter development at Combustion Power Company, 9:49390 (RA;US)
Testing and verification of granular bed filters for removal of particulates and alkalis, 9:49389 (RA;US)
ALKALINE EARTH METAL COMPOUNDS
Catalytic Effects
Catalytic coal gasification, 9:49359 (R;GB)
ALKANOIC ACIDS
See CARBOXYLIC ACIDS
ALKENOIC ACIDS
See CARBOXYLIC ACIDS
ALKYLATING AGENTS
Genetic Effects
Effect of 3-aminobenzamide on the rate of ligation during repair of alkylated DNA in human fibroblasts, 9:50646 (J;US)
ALLOY-713-LC
See INCONEL 713LC
ALLOY-HD-8077
See NICKEL BASE ALLOYS
ALLOY-IN-100
Corrosion
Static and dynamic strength of gas turbine blade material under conditions of high temperature corrosion, 9:50136 (R;DE;In German)
Creep
Static and dynamic strength of gas turbine blade material under conditions of high temperature corrosion, 9:50136 (R;DE;In German)
Fatigue
Static and dynamic strength of gas turbine blade material under conditions of high temperature corrosion, 9:50136 (R;DE;In German)
Tensile Properties
Static and dynamic strength of gas turbine blade material under conditions of high temperature corrosion, 9:50136 (R;DE;In German)
ALLOY-IN-939
Corrosion
Static and dynamic strength of gas turbine blade material under conditions of high temperature corrosion, 9:50136 (R;DE;In German)
Creep
Static and dynamic strength of gas turbine blade material under conditions of high temperature corrosion, 9:50136 (R;DE;In German)
Fatigue
Static and dynamic strength of gas turbine blade material under conditions of high temperature corrosion, 9:50136 (R;DE;In German)
Tensile Properties
Static and dynamic strength of gas turbine blade material under conditions of high temperature corrosion, 9:50136 (R;DE;In German)
ALLOY-MA-754
See NICKEL BASE ALLOYS
ALLOY-MA-956
See IRON BASE ALLOYS
ALLOYS
See also ALUMINIUM ALLOYS
BISMUTH ALLOYS
BORON ALLOYS
CHROMIUM ALLOYS
COBALT ALLOYS
COPPER ALLOYS
CORROSION RESISTANT ALLOYS
GERMANIUM ALLOYS
GOLD ALLOYS
INTERMETALLIC COMPOUNDS
IRON ALLOYS
LITHIUM ALLOYS
MAGNESIUM ALLOYS
MOLYBDENUM ALLOYS
NICKEL ALLOYS
NIOBIUM ALLOYS
RHENIUM ALLOYS
SILICON ALLOYS
SILVER ALLOYS
TIN ALLOYS
TITANIUM ALLOYS
VANADIUM ALLOYS
YTTRIUM ALLOYS
ZIRCONIUM ALLOYS
Electric Conductivity
Resistivity of alloys, 9:50946 (R;US)
Ion Scattering Analysis
Analysis of multicomponent targets using H^+ and He^+ fast ion backscattering, 9:50741 (RA;SU;In Russian)
Use of target rotation method for separation of backscattered ion yields on different types of atoms of multicomponent target, 9:50740 (RA;SU;In Russian)
ALLOY-WAZ-16
See NICKEL BASE ALLOYS

ALPHA DOSIMETRY
Dielectric Track Detectors
Dose estimation by simultaneous measurement of the radon/thoron concentration and the equilibrium factors in air using a passive dosemeter, 9:50480 (R;DE;In German)
ALPHA REACTIONS
Compound-Nucleus Reactions
Chaos near the Coulomb barrier. Nuclear molecules, 9:50833 (R;US)
Elastic Scattering
Dynamic density dependence of the alpha-nucleon force in folding models of inelastic scattering of alpha-particles, 9:50865 (R;DE)
Inelastic Scattering
Dynamic density dependence of the alpha-nucleon force in folding models of inelastic scattering of alpha-particles, 9:50865 (R;DE)
Nuclear Potential
Dynamic density dependence of the alpha-nucleon force in folding models of inelastic scattering of alpha-particles, 9:50865 (R;DE)
Transfer Reactions
Alpha particle induced reactions on ^{42}Ca and the mass 45 bottleneck, 9:50858 (RA;AU)
Proton induced reactions on ^{37}Cl and their relevance to nucleosynthesis, 9:50853 (RA;AU)
ALPHA-BEARING WASTES
Contact Handling
Underground system for disposal of contact handled transuranic waste at the potential Yucca Mountain repository, 9:49559 (R;US)
Emplacement
Underground system for disposal of contact handled transuranic waste at the potential Yucca Mountain repository, 9:49559 (R;US)
Radioactive Waste Disposal
Underground system for disposal of contact handled transuranic waste at the potential Yucca Mountain repository, 9:49559 (R;US)
Radioactive Waste Management
Waste Management Program. Technical progress report, July-September 1983, 9:49549 (R;US)
Radioactive Waste Processing
Off-gas treatment and characterization for a radioactive in situ vitrification test, 9:49556 (R;US)
Vitrification
Off-gas treatment and characterization for a radioactive in situ vitrification test, 9:49556 (R;US)
Waste Transportation
Underground system for disposal of contact handled transuranic waste at the potential Yucca Mountain repository, 9:49559 (R;US)
ALUMINIA
See ALUMINIUM OXIDES
ALUMINIUM
Absorption Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Activation Analysis
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Electron Correlation
Basic studies of atomic dynamics. Progress report, September 1, 1983-July 31, 1984, 9:50727 (R;US)
Emission Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Ion Channeling
Thermal vibration effects in diffusion model calculations of blocking dips, 9:50125 (RA;SU)
Ion Collisions
Anomalous mean free paths for scattering of convoy electrons generated by fast, highly ionized ions in thin solid targets, 9:50725 (R;US)
Ion Implantation
Morphological instabilities and ion beam mixing in Ge. Revision, 9:50099 (R;US)
Ion Scattering Analysis
Description of recoil nuclei energy spectra for element analysis of materials, 9:50736 (RA;SU;In Russian)
Proton Reactions
Use of total shadow profiles for obtaining the information on compounds nuclei lifetime, 9:50854 (RA;SU;In Russian)
Smelting
Removal of polynuclear aromatic hydrocarbons from primary aluminum air pollution control scrubber wastewater, 9:50572 (R;US)
Sonic resonator control and method for determining component concentration in multiple component molten liquids, 9:50146 (P;US)
Soil Chemistry
Attenuation of chemical elements in acidic leachates from coal mineral wastes by soils, 9:49407 (R;US)
Ultrasonic Testing
Ultrasonic girth weld evaluation for aluminum substrate of spherical Kevlar-epoxy test specimens, 9:50418 (R;US)
Work Functions
Edge states and quantized Hall conductivity in a periodic potential, 9:50144 (J;US)
ALUMINIUM 27 TARGET
Nitrogen 14 Reactions
Near-threshold production of neutral π mesons in heavy-ion reactions, 9:50848 (R;US)
Proton Reactions
Influence of orientation of compound nuclei displacement in diametrical plane on axial shadow shape, 9:50855 (RA;SU;In Russian)
ALUMINIUM ALLOYS
See also ALLOY-IN-100
ALLOY-IN-939
ALUMINIUM BASE ALLOYS
INCONEL 713LC
INCONEL 738
Binary Alloy Systems
Development of a melting apparatus for lithium-containig magnesium-aluminium alloys and its application in thermal analysis, 9:50135 (R;DE;In German)
Brinell Hardness
Phase equilibria in aluminium-lithium-magnesium alloys at 200°C, 300°C and 400°C and their hardening in a casting state, 9:50134 (R;DE;In German)
Corrosion
Aluminum alloy performance in industrial air-cooled applications, 9:50156 (J;US)
Deposition
Submicron conductor array fabricated from a recrystallized eutectic thin film, 9:50155 (BA;NL)
Fabrication
Design of ordered intermetallic alloys for high-temperature structural use (Ni_3V-CO_3V-Fe_3V; Ni_3Al), 9:50096 (R;US)
Fatigue
Designing for fatigue with random vibration excitation, 9:50415 (R;US)
Fracture Properties
Boron-induced toughness loss in Ti-6A1-2Nb-1Ta-0.8Mo, 9:50107 (R;US)
Ion Implantation
Ion implantation of surgical Ti-6Al-4V alloy, 9:50590 (R;US)
Lattice Parameters
Defects and disorder in the fast-ion electrode lithium-aluminum, 9:49915 (J;US)
Materials Testing
Designing for fatigue with random vibration excitation, 9:50415 (R;US)
Mechanical Properties
Alloying effects and microstructure of iron aluminides, 9:50097 (R;US)
Design of ordered intermetallic alloys for high-temperature structural use (Ni_3V-CO_3V-Fe_3V; Ni_3Al), 9:50096 (R;US)
Role of boron additions on grain-boundary chemistry and tensile properties of Ni_3Al containing 24 and 26 at. % Al, 9:50106 (R;US)

Microstructure
Alloying effects and microstructure of iron aluminides, 9:50097 (R;US)
Order Parameters
Defects and disorder in the fast-ion electrode lithium-aluminum, 9:49915 (J;US)
Phase Diagrams
Development of a melting apparatus for lithium-containig magnesium-aluminium alloys and its application in thermal analysis, 9:50135 (R;DE;In German)
Phase Studies
Phase equilibria in aluminium-lithium-magnesium alloys at 200°C, 300°C and 400°C and their hardening in a casting state, 9:50134 (R;DE;In German)
Physical Radiation Effects
Radiation-induced compositional redistribution and local phase transformation in irradiated alloys, 9:50101 (R;US)
Recrystallization
Submicron conductor array fabricated from a recrystallized eutectic thin film, 9:50155 (BA;NL)
Ternary Alloy Systems
Development of a melting apparatus for lithium-containig magnesium-aluminium alloys and its application in thermal analysis, 9:50135 (R;DE;In German)

ALUMINIUM ARSENIDES
Electrical Properties
Transport properties of n-type metalorganic chemical-vapor-deposited Al/sub x/Ga/sub 1-x/As (0< or =x< or =0.6), 9:50213 (J;US)

ALUMINIUM BASE ALLOYS
Neutron Diffraction
Neutron diffraction study of the tetragonal $NpCu_4Al_8$ and $ErFe_4Al_8$ intermetallic compounds, 9:50114 (RA;IL)

ALUMINIUM CHLORIDES
Chemical Properties
Electrochemical properties of the solvent $SbCl_3$-$AlCl_3$-N-(1-BUTYL)pyridinium chloride and electrochemical and spectroelectrochemical studies of the solute 9,10-dimethylanthracene, 9:50325 (J;US)
Chemical Reaction Kinetics
Reactivity of anthracene in liquid $SbCl_3$-$AlCl_3$-N-(1-BUTYL)pyridinium chloride mixtures, 9:50327 (J;US)
Electric Conductivity
Chemical reactions among the components in $SbCl_3$-$AlCl_3$-Sb melts, 9:50313 (J;US)
Electrical Properties
Electrochemical properties of the solvent $SbCl_3$-$AlCl_3$-N-(1-BUTYL)pyridinium chloride and electrochemical and spectroelectrochemical studies of the solute 9,10-dimethylanthracene, 9:50325 (J;US)
Solubility
Chemical reactions among the components in $SbCl_3$-$AlCl_3$-Sb melts, 9:50313 (J;US)

ALUMINIUM FLUORIDES
Chemical Reaction Kinetics
Theoretical study of the reaction of AlF^-_4 and $AlCl^-_4$ with oxide and sulfide ions, 9:50314 (J;US)

ALUMINIUM OXIDES
Acoustic Monitoring
Sonic resonator control and method for determining component concentration in multiple component molten liquids, 9:50146 (P;US)
Chemical Reaction Kinetics
Theoretical study of the reaction of AlF^-_4 and $AlCl^-_4$ with oxide and sulfide ions, 9:50314 (J;US)
Electrolysis
Sonic resonator control and method for determining component concentration in multiple component molten liquids, 9:50146 (P;US)
Ion Implantation
Formation of amorphous layers in Al_2O_3 by ion implantation, 9:50157 (R;US)
Sintering
Sub-eutectic densification and second phase formation in Al_2O_3 - CaO, 9:50162 (R;US)
Sorptive Properties
Alkali removal from hot combustion gases by adsorption on submicron-size particles, 9:49393 (RA;US)

ALUMINIUM SILICATES
Chemical Reactions
Chemical effects of entrained particles in coal conversion streams: prediction of PFBC alkali levels, 9:49432 (RA;US)
Materials Testing
High-temperature removal of alkali vapors in hot-gas cleaning systems, 9:49343 (RA;US)

ALUMINIUM-AIR BATTERIES
Capacity
High capacity batteries based on aluminum/oxygen cells, 9:49916 (TJ;US)
Stored Energy
High capacity batteries based on aluminum/oxygen cells, 9:49916 (TJ;US)

ALUMINUM
See ALUMINIUM

AMERICIUM
Environment
Radioecological research on the behavior of actinides in the environment, 9:49870 (RA;DE;In German)

AMERICIUM 241 TARGET
Neutron Reactions
Isomer ratio calculations using modeled discrete levels, 9:50893 (R;US)

AMERICIUM 243 TARGET
Neutron Reactions
Isomer ratio calculations using modeled discrete levels, 9:50893 (R;US)

AMERICIUM OXIDES
Formation Heat
Enthalpy of formation of americium sesquioxide; systematics of actinide sesquioxide thermochemistry, 9:50297 (R;US)

AMINES
See also METHYLAMINE
NITROSAMINES
RHODAMINES
Physical Radiation Effects
Radiation damage in an ethylamine-borane:ammonia target, 9:50441 (R;US)

AMINO ALCOHOLS
See AMINES

AMINO SUGARS
See AMINES

AMINOGLYCIDES
See AMINES

AMMONIA
Phase Studies
Sour water stripping of coal gasification waste water. Final report, 9:49386 (R;US)
Physical Radiation Effects
Radiation damage in an ethylamine-borane:ammonia target, 9:50441 (R;US)
Production
Economic feasibility of cattle manure as a chemical feedstock, 9:49588 (BA;US)
Removal
Sour water stripping of coal gasification waste water. Final report, 9:49386 (R;US)

AMPLIFIERS
See also MICROWAVE AMPLIFIERS
Impedance
Input impedance of an amplifier based on a dc superconducting quantum interference device, 9:50383 (J;US)
SQUID Devices
dc SQUID as a tuned radiofrequency amplifier, 9:50373 (R;US)
Input impedance of an amplifier based on a dc superconducting quantum interference device, 9:50383 (J;US)

ANAEROBIC DIGESTION
See also BIOGAS PROCESS
Stabilization
Thermal treatment of municipal sewage sludges, 9:50551 (R;US)

ANALYSIS (ACTIVATION)
See ACTIVATION ANALYSIS

ANALYSIS (STRUCTURAL CHEMICAL)
See STRUCTURAL CHEMICAL ANALYSIS
ANALYTIC FUNCTIONS
Accuracy
Accuracy of the finite analytic method for scalar transport calculations, 9:51048 (R;US)
ANIMAL CELLS
Includes human cells.
See also CHO CELLS
Oncogenic Transformations
Control of mutagenesis and cell differentiation in cultured human and rodent cells by chemicals that initiate or promote tumor formation, 9:50632 (R;US)
Towards a molecular understanding of sunlight-induced skin cancer in mouse and man, 9:50602 (R;US)
ANL
Microprocessors
Guide to personal desktop computing at ANL, 9:51049 (R;US)
ANTHRACENE
Activation Energy
Reactivity of anthracene in liquid $SbCl_3$-$AlCl_3$-N-(1-BUTYL)pyridinium chloride mixtures, 9:50327 (J;US)
Chemical Reaction Kinetics
Reactivity of anthracene in liquid $SbCl_3$-$AlCl_3$-N-(1-BUTYL)pyridinium chloride mixtures, 9:50327 (J;US)
Retention
Distribution, retention, and fate of 2-aminoanthracene in rats after inhalation, 9:50638 (J;US)
Tissue Distribution
Distribution, retention, and fate of 2-aminoanthracene in rats after inhalation, 9:50638 (J;US)
ANTIFERROMAGNETIC MATERIALS
Magnetic Fields
Experimental studies of random-field effects in uniaxial random antiferromagnets, 9:50942 (R;US)
ANTIMONY
Electric Conductivity
Chemical reactions among the components in $SbCl_3$-$AlCl_3$-Sb melts, 9:50313 (J;US)
Ion Microprobe Analysis
Channeling contrast microscopy: application to large grain polycrystalline silicon, 9:50283 (RA;AU)
Photonuclear Reactions
Photoneutron reaction cross sections of ^{121}Sb, ^{123}Sb and Nat.Sb, 9:50875 (RA;AU)
Solubility
Chemical reactions among the components in $SbCl_3$-$AlCl_3$-Sb melts, 9:50313 (J;US)
ANTIMONY 121 TARGET
Photonuclear Reactions
Photoneutron cross sections of ^{121}Sb, ^{123}Sb and sup(nat) Sb, 9:50877 (R;AU)
Photoneutron reaction cross sections of ^{121}Sb, ^{123}Sb and Nat.Sb, 9:50875 (RA;AU)
ANTIMONY 123 TARGET
Photonuclear Reactions
Photoneutron cross sections of ^{121}Sb, ^{123}Sb and sup(nat) Sb, 9:50877 (R;AU)
Photoneutron reaction cross sections of ^{121}Sb, ^{123}Sb and Nat.Sb, 9:50875 (RA;AU)
ANTIMONY CHLORIDES
Catalytic Effects
Influence of redox and Lewis acid functions of $SbCl_3$-rich molten salt catalysts on the reactions of coal model compounds, 9:50326 (J;US)
Chemical Properties
Electrochemical properties of the solvent $SbCl_3$-$AlCl_3$-N-(1-BUTYL)pyridinium chloride and electrochemical and spectroelectrochemical studies of the solute 9,10-dimethylanthracene, 9:50325 (J;US)
Chemical Reaction Kinetics
Reactivity of anthracene in liquid $SbCl_3$-$AlCl_3$-N-(1-BUTYL)pyridinium chloride mixtures, 9:50327 (J;US)
Electric Conductivity
Chemical reactions among the components in $SbCl_3$-$AlCl_3$-Sb melts, 9:50313 (J;US)
Electrical Properties
Electrochemical properties of the solvent $SbCl_3$-$AlCl_3$-N-(1-BUTYL)pyridinium chloride and electrochemical and spectroelectrochemical studies of the solute 9,10-dimethylanthracene, 9:50325 (J;US)
Redox Reactions
Influence of redox and Lewis acid functions of $SbCl_3$-rich molten salt catalysts on the reactions of coal model compounds, 9:50326 (J;US)
Solubility
Chemical reactions among the components in $SbCl_3$-$AlCl_3$-Sb melts, 9:50313 (J;US)
ANTIPYRINE
Fluorination
^{18}F-4-fluoroantipyrine, 9:50355 (P;US)
Gel Permeation Chromatography
^{18}F-4-fluoroantipyrine, 9:50355 (P;US)
Labelling
^{18}F-4-fluoroantipyrine, 9:50355 (P;US)
ANTIREFLECTION COATINGS
Damage
Alumina/silica multilayer coatings for excimer lasers, 9:50395 (R;US)
ANTITRUST REVIEW
Systems Analysis
Nuclear Regulatory Commission's antitrust review process: an analysis of the impacts, 9:49934 (R;US)
ANTRIM SHALES
See BLACK SHALES
APARTMENT BUILDINGS
Energy Conservation
Energy conservation in public housing: the San Francisco experience, 9:49996 (R;US)
Responding to the conservation needs of low-income and multi-family residential customers, 9:49988 (RA;US)
Specification and cost manual for energy retrofits on small commercial and multifamily buildings, 9:49690 (R;US)
Energy Consumption
Energy conservation in public housing: the San Francisco experience, 9:49996 (R;US)
Energy Efficiency
Energy efficiency in multi-unit residential buildings: a handbook for owners and operators, 9:49998 (R;CA)
Specification and cost manual for energy retrofits on small commercial and multifamily buildings, 9:49690 (R;US)
Energy Management
Energy conservation building operations demonstration for forty high-, medium- and low-rise multiple-unit residential buildings, 9:50011 (R;CA)
Energy Management Systems
Report on the energy management installation at 1765 Weston Road, 9:50009 (R;CA)
Manuals
Specification and cost manual for energy retrofits on small commercial and multifamily buildings, 9:49690 (R;US)
Solar Heating Systems
Collecting well in fine sediment as heat storage for a block of flats in Karlstad. A preliminary study, 9:49967 (R;SE;In Swedish)
Weatherization
Responding to the conservation needs of low-income and multi-family residential customers, 9:49988 (RA;US)
APPARATUS
See EQUIPMENT
APPLIANCES
See also WATER HEATERS
WOOD BURNING APPLIANCES
Marketing
Northern States Power Company Appliance Rebate Program, 9:50050 (RA;US)
AQUACULTURE
Heat Exchangers
An artificial upwelling driven by salinity differences in the ocean, 9:49679 (BA;US)

Upwelling
An artificial upwelling driven by salinity differences in the ocean, 9:49679 (BA;US)
AQUICULTURE
See AQUACULTURE
AQUIFERS
Compressed Air Energy Storage
Outcome of compressed air energy storage at Pittsfield, Illinois, 9:49904 (R;US)
Heat Storage
Field testing of aquifer thermal energy storage, 9:49910 (R;US)
Steady flow model user's guide, 9:49908 (R;US)
Steady Flow
Steady flow model user's guide, 9:49908 (R;US)
ARC FURNACES
Mathematical Models
Mathematical model of the electric arc furnace. Final report, 9:50036 (R;US)
ARCHAEOLOGICAL SPECIMENS
Chemical Analysis
Archaeometry, 9:50285 (RA;AU)
Ion Scattering Analysis
Archaeometry, 9:50285 (RA;AU)
Nuclear Reaction Analysis
Archaeometry, 9:50285 (RA;AU)
PIXE Analysis
Archaeometry, 9:50285 (RA;AU)
Proton Microprobe Analysis
Archaeometry, 9:50285 (RA;AU)
Radiation Curing
Radiation-curable impregnating agents for the conservation of archaelogic wooden objects (Gamma radiation), 9:50347 (R;AT;In German)
Radiation-curable impregnating agents for the conservation of archaeologic wooden objects. Part 2 (Gamma radiation), 9:50348 (R;AT;In German)
ARCTIC REGIONS
Terrestrial Ecosystems
Arctic Terrestrial Environmental Research Programs of the Office of Energy Research, Department of Energy: Evaluations and recommendations. Appendix B: Components of an Arctic Terrestrial Environmental Research Program, 9:50562 (R;US)
ARGON
Ion-Atom Collisions
Forward electron production in heavy ion-atom and ion-solid collisions, 9:50723 (R;US)
ARGON 37 TARGET
Neutron Reactions
Proton induced reactions on ^{37}Cl and their relevance to nucleosynthesis, 9:50853 (RA;AU)
ARGONNE NATIONAL LABORATORY
See ANL
AROMATIC ACIDS
See CARBOXYLIC ACIDS
AROMATIC COMPOUNDS
See AROMATICS
AROMATICS
See also BENZENE
CONDENSED AROMATICS
POLYCYCLIC AROMATIC HYDROCARBONS
QUINONES
Phase Transformations
Luminescence behavior as a probe for phase transitions and excimer formation in liquid crystals: dodecylcyanobiphenyl, 9:50341 (J;NL)
Structural Chemical Analysis
Luminescence behavior as a probe for phase transitions and excimer formation in liquid crystals: dodecylcyanobiphenyl, 9:50341 (J;NL)
ARSENIC
Absorption Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Activation Analysis
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Emission Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Soil Chemistry
Attenuation of chemical elements in acidic leachates from coal mineral wastes by soils, 9:49407 (R;US)
ART OBJECTS
See CULTURAL OBJECTS
ARYL RADICALS
Dehydrocyclization
Arrhenius parameters for rearrangement of the neophyl, 1-indanylmethyl, 2-allylbenzyl, and 2-(2-vinylphenyl)ethyl radicals relative to hydrogen abstraction from tributylstannane, 9:50324 (J;US)
Isomerization
Arrhenius parameters for rearrangement of the neophyl, 1-indanylmethyl, 2-allylbenzyl, and 2-(2-vinylphenyl)ethyl radicals relative to hydrogen abstraction from tributylstannane, 9:50324 (J;US)
ASHES
See also FLY ASH
Chemical Composition
Waste characterization, 9:49427 (RA;US)
Leachates
Attenuation of chemical elements in acidic leachates from coal mineral wastes by soils, 9:49407 (R;US)
Leaching
Studies on the leaching and weathering processes of coal ashes, 9:49398 (R;SE;In Swedish)
Waste characterization, 9:49427 (RA;US)
Sintering
Comparison of low-rank coal ash sintering characteristics with pilot plant ash fouling tendencies, 9:49377 (R;US)
Waste Product Utilization
Solid wastes from coal and shale: projections of waste forms and utilization potential, 9:49384 (R;US)
Weathering
Studies on the leaching and weathering processes of coal ashes, 9:49398 (R;SE;In Swedish)
ASTATINE 203
Decay
Nuclear chemistry research and spectroscopy with radioactive sources. Twentieth annual progress report, September 1, 1983-August 31, 1984, 9:50869 (R;US)
ASTATINE 205
Yrast States
Yrast states and isomers in ^{205}At, 9:50899 (RA;AU)
ASTEROIDS
Chemical Composition
Proposal for electron beam induced remote sensing x-ray fluorescence investigation of minor bodies in the solar system. Experiment IND-X, 9:50673 (R;HU)
X-Ray Fluorescence Analysis
Proposal for electron beam induced remote sensing x-ray fluorescence investigation of minor bodies in the solar system. Experiment IND-X, 9:50673 (R;HU)
ASTROPHYSICS
Research Programs
Nuclear chemistry progress report, 9:50821 (R;US)
ATMOSPHERIC CHEMISTRY
Research Programs
Infrared excitation of clusters and ions of atmospheric interest. First progress report, September 1, 1983-August 31, 1984, 9:50714 (R;US)
ATMOSPHERIC EXPOSURE CHAMBERS
See EXPOSURE CHAMBERS
ATOMIC BOMBS
See NUCLEAR WEAPONS
ATOMIC EXPLOSIONS
See NUCLEAR EXPLOSIONS
ATOMIC SHELLS (K)
See K SHELL
ATOMIC SHELLS (L)
See L SHELL
ATOMIC WEAPONS
See NUCLEAR WEAPONS

ATOMS
Electric Fields
Effects of magnetic and electric fields on highly excited atoms, 9:50753 (BA;US)
Energy Levels
Structure of the periodic system, 9:50750 (R;AT)
Magnetic Fields
Effects of magnetic and electric fields on highly excited atoms, 9:50753 (BA;US)
Photoelectron Spectroscopy
Electron spectrometry experiments with the use of synchrotron radiation, 9:50722 (R;US)
ATROPHY
Physiology
Role of calcium-dependent proteinase in molt-induced claw muscle atrophy, 9:50601 (R;US)
AUSTENITIC STEELS
Prior to February, 1978 STEELS and AUSTENITE were used to index this concept.
Swelling
Swelling and swelling resistance possibilities of austenitic stainless steels in fusion reactors, 9:50095 (R;US)
AUTOMATION
Meetings
Autos 82. Volume 2. Automation in engineering, 9:50358 (R;CS;In Czech)
Autos 82. Volume 3. Automation in engineering, 9:50371 (R;CS;CZ)
Autos 82. Volume 4. Automation in engineering, 9:50369 (R;CS;CZ)
Autos 82. Volume 1. Automation in engineering, 9:50370 (R;CS;CZ)
AUTOMOBILE EFFICIENCY STANDARDS
See AUTOMOBILES
AUTOMOBILE INDUSTRY
See AUTOMOTIVE INDUSTRY
AUTOMOBILES
Control Systems
Possibilities of electronics and microelectronics for optimation of the fuel consumption of cars, 9:50074 (RA;DD;In German)
Fuel Consumption
Possibilities of electronics and microelectronics for optimation of the fuel consumption of cars, 9:50074 (RA;DD;In German)
Fuel Economy
Estimate of changes to fuel economy label values resulting from the proposed mid-year label updating. Technical report, 9:50016 (R;US)
History and description of the EPA (Environmental Protection Agency) motor vehicle fuel economy program. Technical report, 9:50015 (R;US)
Microelectronics
Possibilities of electronics and microelectronics for optimation of the fuel consumption of cars, 9:50074 (RA;DD;In German)
AUTOMOTIVE FUELS
Fuel Substitution
Liquid gas operation, 9:50088 (RA;DD;In German)
AUTOMOTIVE INDUSTRY
Economic Impact
Cost analysis of proposed changes to 40 CFR (Code of Federal Regulations) Part 600 to improve fuel economy labeling and the fuel economy data base. Technical report, 9:50017 (R;US)
Regulations
Cost analysis of proposed changes to 40 CFR (Code of Federal Regulations) Part 600 to improve fuel economy labeling and the fuel economy data base. Technical report, 9:50017 (R;US)
AUTORADIOGRAPHY
Mathematical Models
Mathematical model to determine incorporated quantities of radioactivity from the measured photometric values of tritium-autoradiographs in neuroanatomy, 9:50592 (R;DE;In German)
Photometry
Mathematical model to determine incorporated quantities of radioactivity from the measured photometric values of tritium-autoradiographs in neuroanatomy, 9:50592 (R;DE;In German)
AVIATION FUELS
Sales
Petroleum marketing monthly, July 1984, 9:49455 (R;US)
AVR REACTOR
Juelich, Federal Republic of Germany
Reactor Physics
Installation of a three-dimensional simulation method for core-physical description of pebble bed reactors with multiple recycling process at the example of the AVR, 9:49800 (R;DE;In German)
AZIDES
For inorganic compounds only. For organic azides, use AZIDO COMPOUNDS.
Combustion
Synthesis of refractory materials, 9:50165 (P;US)

B

BACKGROUND RADIATION
Quantitative Chemical Analysis
Quantitative characteristics of the radiation background components in the Vitosha Mountain area and around nuclear reactor IRT-2000, Sofia, 9:49829 (RA;BG;In Bulgarian)
Results and quantitative evaluations of the radionuclides and the level of the radiation background in Vitosha Mountain area and around the nuclear reactor IRT-2000, Sofia, 9:49830 (RA;BG;In Bulgarian)
Thermoluminescent Dosimetry
Determination of the natural gamma background by means of TLD. Some results of the environmental monitoring around the IRT-2000 reactor in Sofia, 9:49831 (RA;BG;In Bulgarian)
BACON
See MEAT
BACTERIA
Metabolism
Size distribution of planktonic autotrophy and microheterotrophy in DeGray Reservoir, Arkansas, 9:50564 (R;US)
BAG MODEL
Meson Resonances
Rho decay in the cloudy bag model, 9:50808 (RA;AU)
Quark-Antiquark Interactions
Scattering and cluster properties in relativistic models of directly interacting confined quarks, 9:50792 (BA;NL)
Quark-Quark Interactions
Scattering and cluster properties in relativistic models of directly interacting confined quarks, 9:50792 (BA;NL)
BAGHOUSES
Efficiency
Particulate characterization, 9:49753 (RA;US)
Emission
Particulate characterization, 9:49753 (RA;US)
BALLOONING INSTABILITY
Shear-Alfven dynamics of toroidally confined plasmas. Part B, 9:51006 (R;US)
Shear-Alfven dynamics of toroidally confined plasmas. Part A, 9:51005 (R;US)
BANKS
See COMMERCIAL BUILDINGS
BARIUM
Absorption Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Activation Analysis
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)

Emission Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
BARIUM 130
Vibrational States
Octupole-vibrational states in the even mass isotopes of barium, 9:50874 (RA;AU)
BARIUM 132
Vibrational States
Octupole-vibrational states in the even mass isotopes of barium, 9:50874 (RA;AU)
BARIUM 134
Vibrational States
Octupole-vibrational states in the even mass isotopes of barium, 9:50874 (RA;AU)
BARIUM 136
Vibrational States
Octupole-vibrational states in the even mass isotopes of barium, 9:50874 (RA;AU)
BARIUM 138
Vibrational States
Octupole-vibrational states in the even mass isotopes of barium, 9:50874 (RA;AU)
BARIUM 138 TARGET
Lithium 7 Reactions
Coulomb excitation of the nucleus ^{7}Li, 9:50841 (RA;AU)
BARSTOW SOLAR PILOT PLANT
10-MW solar central receiver pilot plant at Barstow, California.
Diagrams
Solar One, 9:49678 (R;US)
Information Centers
Specification for Information Center, Solar One Generating Station. Addendum No. 1, 9:49668 (R;US)
Manuals
Solar One Generating Station, Daggett, California: Start-up and Test Program Manual, 9:49669 (R;US)
Planning
10-MWe solar thermal central receiver pilot plant operational test management plan. Three year power production phase effective August 1, 1984, 9:49671 (R;US)
Program Management
10-MWe solar thermal central receiver pilot plant operational test management plan. Three year power production phase effective August 1, 1984, 9:49671 (R;US)
Specifications
Furnish and install control building passenger elevator, Solar One Generating Station. Specification 40-0105, 9:49667 (R;US)
Start-Up
Solar One Generating Station, Daggett, California: Start-up and Test Program Manual, 9:49669 (R;US)
Testing
Solar One Generating Station, Daggett, California: Start-up and Test Program Manual, 9:49669 (R;US)
Turbogenerators
Solar One turbine-generator, turbine 197845 start-up checklist, 9:49670 (R;US)
BASALT
Mechanical Properties
Physical characterization of magma. Progress report, 9:50666 (R;US)
Radioactive Waste Disposal
Nuclear waste repository in basalt: preliminary socioeconomic assessment, 9:49558 (R;US)
Thermodynamic Properties
Physical characterization of magma. Progress report, 9:50666 (R;US)
BATTERIES (ELECTRIC)
See ELECTRIC BATTERIES
BATTERY CHARGERS
Rectifiers
Metallic-rectifier battery chargers for lead-acid batteries. Specification No. A10-1976 (Revision of A10-1972), 9:49912 (R;US)
Specifications
Metallic-rectifier battery chargers for lead-acid batteries. Specification No. A10-1976 (Revision of A10-1972), 9:49912 (R;US)
BEAM EMITTANCE
Beam Monitoring
Using television cameras to measure emittance, 9:50453 (R;US)
BEAM INJECTION
See also NEUTRAL ATOM BEAM INJECTION
Research Programs
Progress report on negative ion beams based on User Development Workshop on negative ion based neutral beams, 15-16 February, 1983, Princeton, 9:51016 (RA;GB)
BEAM PERVEANCE
See BEAM EMITTANCE
BEAM TRANSPORT
Mathematical Models
The generation and use of semi-empirical electron transport models, 9:50455 (J;US)
BEAUTY PARTICLES
Lifetime
Semi-phenomenological approach to beauty-decay, 9:50787 (R;AT)
Particle Decay
Semi-phenomenological approach to beauty-decay, 9:50787 (R;AT)
BEEF
See MEAT
BELGIUM
Biomass Conversion Plants
Biomethanization plant in Baillonville, 9:49580 (R;LU)
Radioactive Waste Processing
Processing of highly radioactive nuclear waste, 9:49563 (TJ;GB)
BENZENE
Photoionization
Multiphoton ionization of benzene in solution, 9:50334 (R;US)
BERYLLIUM
Electron Correlation
Basic studies of atomic dynamics. Progress report, September 1, 1983-July 31, 1984, 9:50727 (R;US)
BERYLLIUM 9
E1-Transitions
E1 decay of the first excited state of ^{9}Be, 9:50837 (RA;AU)
Energy Levels
Shell-model description of narrow, highly-excited states in ^{9}Be, 9:50835 (RA;AU)
Shell Models
Shell-model description of narrow, highly-excited states in ^{9}Be, 9:50835 (RA;AU)
BERYLLIUM 9 TARGET
Electron Reactions
Shell-model description of narrow, highly-excited states in ^{9}Be, 9:50835 (RA;AU)
Neutron Reactions
Neutron nuclear data of ^{9}Be adopted in JENDL-2, 9:50846 (R;JP)
BERYLLIUM MODERATORS
See BERYLLIUM
BETA BEAMS (ELECTRONS)
See ELECTRON BEAMS
BETA DECAY
For neutron and nuclear decay.
Half-Life
Accelerating beta decay rates, 9:50918 (J;CH)
BETATRONS
Beam Dynamics
Flux diffusion and acceleration in a high current modified betatron. Memorandum report, 9:50451 (R;US)
BIBLIS REACTOR
See BIBLIS-A REACTOR
BIBLIS-A REACTOR
Reliability
Experience with regard to safety of installations at the Biblis nuclear power plant, 9:49877 (RA;DE;In German)
BIBLIS-B REACTOR
Biblis, Hessen, Federal Republic of Germany
Reactor Safety
Release of radioactivity and formation of aerosols during LWR core meltdown, 9:49881 (RA;DE;In German)

BIOGAS
See METHANE
BIOGAS PROCESS
Curriculum Guides
Biogas curriculum: workshop, April 6-11, 1981, 9:49578 (R;US)
BIOLOGICAL MATERIALS
Activation Analysis
Microelements '80. Conference proceedings, 9:50267 (R;CS;In Czech and Slovak)
Problems of chromium determination in biological materials, 9:50269 (RA;CS;In Czech)
Trace element determination in biological materials by neutron activation analysis, 9:50268 (RA;CS;In Czech)
BIOMASS
Bibliographies
Farm and forest biomass - an energy source for Europe, 9:49611 (R;LU)
Energy Source Development
Biomass and regions: Series fast No. 14. Summary report, 9:49960 (R;LU;In French)
BIOMASS CONVERSION PLANTS
Use only for plants converting biomass to fuel, do NOT use for plants preparing wastes and biomass for combustion.
Design
Economic feasibility of cattle manure as a chemical feedstock, 9:49588 (BA;US)
Economic Analysis
Economic feasibility of cattle manure as a chemical feedstock, 9:49588 (BA;US)
Economics
Economic optimization of anaerobic fermenter designs for beef production units, 9:49583 (BA;US)
Net Energy
Economic optimization of anaerobic fermenter designs for beef production units, 9:49583 (BA;US)
Optimization
Economic optimization of anaerobic fermenter designs for beef production units, 9:49583 (BA;US)
BIOMASS PLANTATIONS
Environmental Impacts
Forest nutrient cycles as affected by climate, species composition, stand age, and intensive harvesting, 9:49605 (R;US)
Feasibility Studies
Regional study of land suitability and potential availability for energy farming. Phase I report (New Zealand), 9:49622 (R;NZ)
Site Selection
Regional study of land suitability and potential availability for energy farming. Phase I report (New Zealand), 9:49622 (R;NZ)
BIPYRIDINES
Radiosensitivity Effects
Paraquat and radiation effects on mouse C_3H 10T1/2 cells, 9:50617 (J;US)
BIRDS
Abundance
Report to the Shetland Oil Terminal Environmental Advisory Group on the 1982 and 1983 surveys of Eider moult flocks, 9:49462 (R;GB)
Mortality
Report to the Shetland Oil Terminal Environmental Advisory Group on the Shetland Beached Bird Survey, March 1982-February 1983, 9:49464 (R;GB)
Report to the Shetland Oil Terminal Environmental Advisory Group on the Beached Bird Survey in Shetland, March 1980-February 1982, with a review of results since July 1978, 9:49465 (R;GB)
Population Dynamics
Report to SOTEAG (Shetland Oil Terminal Environmental Advisory Group) on numbers of Tysties ('Cepphus grylle') in the area of the Yell Sound Islands, September 1982, 9:49463 (R;GB)
Species Diversity
Bird communities and vegetation structure in pine plantations of the southeastern Coastal Plain, 9:50546 (R;US)
BISMUTH
Ion Implantation
Investigation of intermediate mass ion implantation in bismuth (Chlorine and nitrogen ion implantation), 9:50123 (RA;SU;In Russian)
Physical Radiation Effects
Investigation of intermediate mass ion implantation in bismuth (Chlorine and nitrogen ion implantation), 9:50123 (RA;SU;In Russian)
BISMUTH 209
Energy Levels
Exponentially decreasing newtonian force in the place of Yukawa potential, 9:50898 (RA;BG;In Bulgarian)
Particle-Core Model
Exponentially decreasing newtonian force in the place of Yukawa potential, 9:50898 (RA;BG;In Bulgarian)
BISMUTH ALLOYS
Grain Boundaries
Atomistic studies of grain boundaries with segregated impurities. Final progress report, July 1983-June 30, 1984, 9:50108 (R;US)
BITUMINOUS COAL
Infrared Spectra
Novel analytical approaches to the study of coal beneficiation. Quarterly report, 9:49382 (R;US)
Oxidation
Novel analytical approaches to the study of coal beneficiation. Quarterly report, 9:49382 (R;US)
BLACK HOLES
Gravitational Fields
Gravitational field strength and generalized Komar-integral, 9:50976 (R;AT)
Nucleation
Nucleation rate for black holes, 9:50707 (J;US)
Perturbation Theory
Static spin-3/2 perturbations of two-black hole system, 9:50705 (R;AT)
Spinors
Static spin-3/2 perturbations of two-black hole system, 9:50705 (R;AT)
BLACK LUNG DISEASE
See PNEUMOCONIOSES
BLACK SHALES
Directional Drilling
Feasibility study: vertical fracturing in directionally drilled wells. Final report, January 1983-September 1983, 9:49482 (R;US)
Environmental Impacts
The reactivity of pyrite in raw eastern oil shale and its transformation during processing, 9:49506 (BA;US)
Geochemistry
Eastern gas shales subprogram (Appalachia, Illinois and Michigan Basins), 9:49474 (R;US)
Physiochemical characterization of the Devonian Chattanooga Shale in North Alabama and South-Central Tennessee, 9:49502 (BA;US)
The geology and geochemistry of Devonian Shales in South and West Central Kentucky, 9:49492 (BA;US)
Geology
Eastern gas shales subprogram (Appalachia, Illinois and Michigan Basins), 9:49474 (R;US)
Hydraulic Fracturing
Feasibility study: vertical fracturing in directionally drilled wells. Final report, January 1983-September 1983, 9:49482 (R;US)
Resource Assessment
Eastern gas shales subprogram (Appalachia, Illinois and Michigan Basins), 9:49474 (R;US)
Resource Potential
Physiochemical characterization of the Devonian Chattanooga Shale in North Alabama and South-Central Tennessee, 9:49502 (BA;US)
Sedimentation
A tectonic-climatic approach to the deposition of the Devonian-Mississippian black-shale sequence of North America, 9:49493 (BA;US)

Solvent Extraction
The importance of hydrogen donors in the solvent conversion of eastern shale, 9:49499 (BA;US)
Stratigraphy
The geology and geochemistry of Devonian Shales in South and West Central Kentucky, 9:49492 (BA;US)
BLADES (TURBINES)
See TURBINE BLADES
BLENDING
See MIXING
BLOCKING
See CHANNELING
BLOWDOWN
Fluid-Structure Interactions
Fluid-structure-interaction of the pressurized water reactor core internals during blowdown - numerical simulation with a homogenization model, 9:49883 (R;DE;In German)
Reactor Safety
Assessment of integrity for the pressure vessel internals of PWRs under blowdown loadings, 9:49879 (RA;DE;In German)
Research Programs
Status of the reactor safety research in the Project Nuclear Safety, 9:49864 (RA;DE;In German)
BNL
Energy Management
Energy management review, 9:49942 (R;US)
Research Programs
Photovoltaic-electrolyzer system transient simulation results, 9:49656 (BA;US)
BOILERS
Afterburners
Application of reburning for NO(x) control to a firetube package boiler. Report for April 1983-March 1984, 9:50434 (R;US)
Field Tests
High efficiency residential condensing gas forced air and high efficiency pulse boilers field evaluation - final report (project report No. 5B), 9:50012 (R;CA)
Fouling
Comparison of low-rank coal ash sintering characteristics with pilot plant ash fouling tendencies, 9:49377 (R;US)
Retrofitting
Information on coal conversion activities at selected powerplants, 9:49953 (R;US)
BOILING WATER COOLED AND MODERATED REACTO
See BWR TYPE REACTORS
BONE TISSUES
Histological Techniques
Role of histological techniques for preparation of bone in studies of Pu, 9:50610 (R;IT;In Italian)
BONNEVILLE POWER ADMINISTRATION
Status of Bonneville Power Administration's efforts to improve its oversight of three nuclear power projects, 9:49792 (R;US)
Energy Policy
Environmental assessment on Bonneville Power Administration's proposed policy for sales of nonfirm energy for service to loads with alternate fuel capability, 9:50583 (R;US)
BORANES
Physical Radiation Effects
Radiation damage in an ethylamine-borane:ammonia target, 9:50441 (R;US)
BORON
Biological Effects
Waste characterization, 9:49427 (RA;US)
Metallurgical Effects
Boron-induced toughness loss in Ti-6A1-2Nb-1Ta-0.8Mo, 9:50107 (R;US)
BORON 10
Nuclear Reaction Analysis
Microscopic determination of ^{10}B for boron neutron capture therapy of malignant melanoma, 9:50279 (RA;AU)
BORON ALLOYS
Neutron Diffraction
Neutron diffraction experiments on amorphous alloys, 9:50131 (R;HU)
BORON CARBIDES
Electron Spectroscopy
Reliability of the quantification of EELS measurements, 9:50158 (R;US)
BORON CHLORIDES
Photolysis
Method of separating boron isotopes, 9:50309 (P;US)
BORON ISOTOPES
See also BORON 10
Laser Isotope Separation
Method of separating boron isotopes, 9:50309 (P;US)
BOROSILICATE GLASS
Chemical Composition
Nuclear waste glass composition limitations, 9:49557 (R;US)
BOROSILICATES
See BOROSILICATE GLASS
BOSE-EINSTEIN GAS
Ground States
Ground state energy of an interacting bose gas, 9:50974 (R;AT)
BOSONS
See also GOLDSTONE BOSONS
Vacuum States
Quantum effects in the Schwinger model, 9:50804 (RA;BG;In Bulgarian)
BOUNDARIES (GRAIN)
See GRAIN BOUNDARIES
BPA
See BONNEVILLE POWER ADMINISTRATION
BRAIDWOOD-1 REACTOR
Braidwood, Illinois, USA
Environmental Impact Statements
Final environmental statement related to the operation of Braidwood Station, Units 1 and 2 (Docket Nos. STN 50-456 and STN 50-457), 9:50586 (R;US)
BRAIDWOOD-2 REACTOR
Braidwood, Illinois, USA
Environmental Impact Statements
Final environmental statement related to the operation of Braidwood Station, Units 1 and 2 (Docket Nos. STN 50-456 and STN 50-457), 9:50586 (R;US)
BRAIN
Emission Computed Tomography
Radiohalogen-labeled imaging agents. 3. Compounds for measurement of brain blood flow by emission tomography, 9:50595 (J;US)
BRAKING RADIATION
See BREMSSTRAHLUNG
BREAKWATERS
See DAMS
BREMSSTRAHLUNG
Quantum Electrodynamics
Multiple bremsstrahlung in gauge theories at high energies. Pt. 3, 9:50772 (R;DE)
BRINES
Chemical Analysis
Downhole sampling of geopressured gas wells. Final report, June 1982-July 1984, 9:49477 (R;US)
Chemical Composition
Study of scale and noncondensables in an evaporator. Annual report, 1 October 1983-30 September 1984, 9:49729 (R;US)
Corrosive Effects
Evaluation of the three-point method to measure corrosion rates, 9:49730 (J;US)
BROMINE
Activation Analysis
Neutron activation analysis on a series of human gallstones, 9:50272 (RA;AU)
BROMINE BROMIDES
See BROMINE
BRONCHOGENIC CARCINOMA
See RESPIRATORY SYSTEM DISEASES
BROOKHAVEN NATIONAL LABORATORY
See BNL
BROWN COAL
See also LIGNITE

Production
Environmental impact of the extraction, processing and utilisation of coal in the Federal Republic of Germany. Part 2. Brown coal (FRG), 9:49414 (R;LU;In German)

BSF REACTOR
See BSR-1 REACTOR

BSR-1 REACTOR
Reactor Operation
Bulk Shielding Facility. Quarterly report, January-March 1984, 9:49838 (R;US)

BUILDING MATERIALS
See also CONCRETES
Natural Radioactivity
Dose estimation by simultaneous measurement of the radon/thoron concentration and the equilibrium factors in air using a passive dosemeter, 9:50480 (R;DE;In German)

BUILDINGS
See also COMMERCIAL BUILDINGS
CONTAINMENT BUILDINGS
GREENHOUSES
LABORATORY BUILDINGS
OFFICE BUILDINGS
PUBLIC BUILDINGS
RESIDENTIAL BUILDINGS
SCHOOL BUILDINGS
Airtightness
Methods for measuring the airtightness and air change rates in buildings, 9:50023 (R;FI;In Finnish)
Cooling Load
Computing building heat loads. A comparative survey of four heat load determination programmes. Final report, 9:50003 (R;NZ)
Energy Consumption
Comparisons of predicted and measured energy use in occupied buildings, 9:49994 (R;US)
Evaluation of thermal energy conservation schemes for an experimental masonry building. Final report, 9:49689 (R;US)
Southwest Thermal Mass Study, Tesuque Pueblo, New Mexico: the effect of envelope thermal mass on the heating energy use of eight test buildings in a high desert climate (September 1981-December 1982), 9:50005 (R;US)
Energy Models
Comparisons of predicted and measured energy use in occupied buildings, 9:49994 (R;US)
Heating Load
Computing building heat loads. A comparative survey of four heat load determination programmes. Final report, 9:50003 (R;NZ)
Thermal Analysis
Southwest thermal mass study, Tesuque Pueblo, New Mexico. Observation and prediction of the heating season thermal mass effect for eight test buildings with and without windows. Research Phase II, January 1983-June 1983, 9:49687 (R;US)
Thermal Mass
Southwest thermal mass study, Tesuque Pueblo, New Mexico. Observation and prediction of the heating season thermal mass effect for eight test buildings with and without windows. Research Phase II, January 1983-June 1983, 9:49687 (R;US)
Southwest Thermal Mass Study, Tesuque Pueblo, New Mexico: the effect of envelope thermal mass on the heating energy use of eight test buildings in a high desert climate (September 1981-December 1982), 9:50005 (R;US)

BUILDINGS (CONTAINMENT)
See CONTAINMENT BUILDINGS

BULGARIA
Energy Policy
Methods and models for system assessment of long-term development of energy complex of People's Republic of Bulgaria, 9:49924 (RA;BG;In Bulgarian)
Natural Radioactivity
Gamma-ray emitting radionuclides in environmental samples from the South-West Bulgaria, 9:50558 (RA;BG;In Bulgarian)
Power Plants
Methods and models for system assessment of long-term development of energy complex of People's Republic of Bulgaria, 9:49924 (RA;BG;In Bulgarian)

BULGARIAN RESEARCH REACTOR IRT-2000
See IRT-SOFIA REACTOR

BULK SHIELDING REACTOR-1
See BSR-1 REACTOR

BUNDLES (FUEL ELEMENTS)
See FUEL ELEMENT CLUSTERS

BUNKER OILS
See RESIDUAL FUELS

BURNERS
See also GAS BURNERS
OIL BURNERS
Limestone
Brief review of planned R and D (research and development) in the LIMB (Limestone Injection Multistage Burner) development program, 9:50432 (R;US)

BURSA OF FABRICIUS
See BIRDS

BUTADIENE
Adsorption Isotherms
Separation factor method for the analysis of ideal binary mixtures in gas-solid adsorption, 9:50293 (J;US)
Separation Processes
Separation factor method for the analysis of ideal binary mixtures in gas-solid adsorption, 9:50293 (J;US)

BUTANE
Adsorption Isotherms
Separation factor method for the analysis of ideal binary mixtures in gas-solid adsorption, 9:50293 (J;US)
Chemical Reactions
Reactions of $FeCH_3i$ and $CoCH_3^+$ with aliphatic alkanes in the gas phase, 9:50322 (J;US)
Data Compilation
Petroleum supply monthly, July 1984, 9:49454 (R;US)
Separation Processes
Separation factor method for the analysis of ideal binary mixtures in gas-solid adsorption, 9:50293 (J;US)

BUTYL RADICALS
Formation Heat
Photoelectron spectroscopy of 1-propyl, 1-butyl, isobutyl, neopentyl, and 2-butyl radicals: free radical precursors to high-energy carbonium ion isomers (Studied at elevated temperature to increase extent of radical decomposition), 9:50357 (J;US)
Ionization Potential
Photoelectron spectroscopy of 1-propyl, 1-butyl, isobutyl, neopentyl, and 2-butyl radicals: free radical precursors to high-energy carbonium ion isomers (Studied at elevated temperature to increase extent of radical decomposition), 9:50357 (J;US)

BWR TYPE REACTORS
See also SHOREHAM REACTOR
Cost
Technical reference book for the Energy Economic Data Base (EEDB) Program, 9:49791 (R;US)
Economics
Technical reference book for the Energy Economic Data Base (EEDB) Program, 9:49791 (R;US)
Failed Element Detection
On-line acquisition and evaluation of core measuring data in light water reactors, 9:49769 (TJ;GB)
In Core Instruments
On-line acquisition and evaluation of core measuring data in light water reactors, 9:49769 (TJ;GB)
Meltdown
MARCH 2 (Meltdown Accident Response Characteristics) code description and user's manual, 9:49894 (R;US)
Pipes
Loadings in horizontal feedwater pipes of LWRs by thermal shock and temperature differences due to thermal layers, 9:49767 (RA;DE;In German)
Primary Coolant Circuits
US NRC research on the integrity of piping in nuclear reactor primary systems, 9:49768 (RA;DE)
Reactor Accidents
Review of areas that may require simultaneous coupled solution of the thermal hydraulic and fission product/aerosol

behavior equations for source term determination, 9:49853 (R;US)
Reactor Safety
BWR Full Integral Simulation Test (FIST) program: facility description report, 9:49889 (R;US)
Engineer-constructor's view of nuclear power plant safety, 9:49876 (RA;DE)
EPRI research on hydrogen combustion and control, 9:49866 (RA;DE)
Stress Corrosion
BWR water chemistry impurity studies: literature review of effects on stress corrosion cracking, 9:49766 (R;US)
Water Chemistry
BWR water chemistry impurity studies: literature review of effects on stress corrosion cracking, 9:49766 (R;US)

C

CABLES
Destructive Testing
New downhole cable emplacement method developed for LLNL's Nuclear Test Program, 9:50512 (R;US)
Installation
New downhole cable emplacement method developed for LLNL's Nuclear Test Program, 9:50512 (R;US)
CADMIUM
Soil Chemistry
Attenuation of chemical elements in acidic leachates from coal mineral wastes by soils, 9:49407 (R;US)
CAES
See COMPRESSED AIR ENERGY STORAGE
CALCIUM
Absorption Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Activation Analysis
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Emission Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
X-Ray Fluorescence Analysis
On-stream determination of Zn-content in Zn-ore slurries by radioisotope excited X-ray fluorescence, 9:50291 (R;AT)
CALCIUM 40 TARGET
Pion Minus Reactions
Dependence of the excitation energy, width, and cross section of the isovector monopole resonance, 9:50878 (J;FR)
Pion Plus Reactions
Dependence of the excitation energy, width, and cross section of the isovector monopole resonance, 9:50878 (J;FR)
Pion Reactions
Excitation of giant resonances in pion charge-exchange reactions, 9:50879 (J;FR)
Proton Reactions
$^{40}Ca(p,pd)^{39}K$ and $^{40}Ca(p,2p)^{39}K$ reactions at 150 MeV, 9:50862 (RA;AU)
CALCIUM 42 TARGET
Alpha Reactions
Alpha particle induced reactions on ^{42}Ca and the mass 45 bottleneck, 9:50858 (RA;AU)
CALCIUM 44
Isotope Effects
Calcium hydroxide isotope effect in calcium isotope enrichment by ion exchange, 9:50311 (J;US)
Isotope Separation
Calcium hydroxide isotope effect in calcium isotope enrichment by ion exchange, 9:50311 (J;US)
CALCIUM 45
Foliar Uptake
Absorption of ^{45}Ca during the immersion of the aerial organs of Salicornia stricta, 9:50603 (R;FR;FR)
Tissue Distribution
Absorption of ^{45}Ca during the immersion of the aerial organs of Salicornia stricta, 9:50603 (R;FR;FR)
CALCIUM 48
Isotope Effects
Calcium hydroxide isotope effect in calcium isotope enrichment by ion exchange, 9:50311 (J;US)
Isotope Separation
Calcium hydroxide isotope effect in calcium isotope enrichment by ion exchange, 9:50311 (J;US)
CALCIUM 48 TARGET
Deuteron Reactions
$^{48}Ca(d,^3He)^{47}K$ reaction at 80 MeV, 9:50863 (RA;AU)
Photonuclear Reactions
$^{48}Ca(\gamma,n+p)$ photonuclear cross section in the giant dipole resonance region, 9:50861 (RA;AU)
CALCIUM CARBONATES
See also SHORTITE
Chemical Reaction Kinetics
Development of a hot gas cleanup system for integrated coal gasification/molten carbonate fuel cell power plants, 9:49341 (RA;US)
CALCIUM HYDROXIDES
Sorptive Properties
SO/sub x//NO/sub x/ control, 9:49752 (RA;US)
CALCIUM OXIDES
Sintering
Sub-eutectic densification and second phase formation in Al_2O_3 - CaO, 9:50162 (R;US)
CALCULI
In biology and medicine only; to be assigned in coordination with descriptors specifying their location such as URINARY TRACT, PANCREAS, etc.
Activation Analysis
Neutron activation analysis on a series of human gallstones, 9:50272 (RA;AU)
CALIFORNIA
Hydroelectric Power
Water resources appraisal for hydroelectric licensing: Middle San Joaquin Valley basin, Fresno, Madera, Mariposa, and Merced Counties, California, 9:49593 (R;US)
Water resources appraisal for hydroelectric licensing: Middle San Joaquin Valley basin, Fresno, Madera, Mariposa, and Merced Counties, California, 9:49594 (R;US)
CALIFORNIUM 249
Magnetic Susceptibility
Magnetism of californium metal, 9:50102 (R;US)
CALORIMETERS (PARTICLE)
See SHOWER COUNTERS
CAMERAS
See also NEUTRON CAMERAS
Positioning
Automatic camera tracking for remote manipulators, 9:49516 (R;US)
CANADA
Continental Shelf
Summary of United States-Canada and United States-Mexico maritime boundary disputes in relationship to hydrocarbon resources, 9:49469 (R;US)
Pipelines
Alaska Natural Gas Transportation System, 9:49485 (R;US)
CANCER
See NEOPLASMS
CANDU TYPE REACTORS
Neutron Transport
Approach to neutronics analysis of CANDU reactors, 9:49781 (R;PK)
CARBIDES
See also BORON CARBIDES
SILICON CARBIDES
TITANIUM CARBIDES
TUNGSTEN CARBIDES
Physical Properties
Existence and structure of rare earth monocarbides: study of their magnetic properties at low temperatures, 9:50171 (TG;US)

CARBON
See also ACTIVATED CARBON
DIAMONDS
GRAPHITE
Ion Collisions
Anomalous mean free paths for scattering of convoy electrons generated by fast, highly ionized ions in thin solid targets, 9:50725 (R;US)
Optical Properties
Arc-evaporated carbon films: optical properties and electron mean free paths, 9:50183 (R;US)
Production
Carbon particles, 9:50214 (P;US)
CARBON 12 REACTIONS
Compound-Nucleus Reactions
Chaos near the Coulomb barrier. Nuclear molecules, 9:50833 (R;US)
Nuclear molecules in TDHF, 9:50834 (R;US)
CARBON 12 TARGET
Carbon 12 Reactions
Chaos near the Coulomb barrier. Nuclear molecules, 9:50833 (R;US)
Nuclear molecules in TDHF, 9:50834 (R;US)
Neutron Reactions
Evaluation of neutron nuclear data for ^{13}C, 9:50844 (R;XN)
Photonuclear Reactions
Photoneutron cross section for ^{12}C, ^{14}N and ^{16}O, 9:50840 (RA;AU)
Pion Plus Reactions
Excitation of giant resonances in pion inelastic scattering, 9:50847 (J;FR)
Pion Reactions
Analytic distorted wave approximation for intermediate energy pion and proton inelastic scattering, 9:50836 (RA;AU)
Proton Reactions
Analytic distorted wave approximation for intermediate energy pion and proton inelastic scattering, 9:50836 (RA;AU)
CARBON 13 REACTIONS
Fusion Reactions
Yrast states and isomers in ^{205}At, 9:50899 (RA;AU)
CARBON 13 TARGET
Alpha Reactions
Location of 3p-3h strength in ^{16}N via the reaction $^{13}C(\alpha,p)^{16}N$ at 118 MeV, 9:50842 (RA;AU)
CARBON 14 TARGET
Alpha Reactions
Chaos near the Coulomb barrier. Nuclear molecules, 9:50833 (R;US)
CARBON CYCLE
Reviews
Some aspects of understanding changes in the global carbon cycle, 9:50523 (R;US)
CARBON DIOXIDE
Environmental Impacts
Simulating responses to expected climate change in eastern North America: applications to decision-making in the forest industry, 9:50547 (R;US)
Phase Studies
Sour water stripping of coal gasification waste water. Final report, 9:49386 (R;US)
Removal
Sour water stripping of coal gasification waste water. Final report, 9:49386 (R;US)
Research Programs
Carbon dioxide and climate: summaries of research in FY 1983 and FY 1984, 9:50525 (R;US)
CARBON DIOXIDE INJECTION
Additives
Enhanced oil recovery by CO_2 foam flooding. Quarterly report, July 1-September 30, 1984, 9:49448 (R;US)
Bench-Scale Experiments
Enhanced oil recovery by CO_2 foam flooding. Quarterly report, July 1-September 30, 1984, 9:49448 (R;US)
CARBON DIOXIDE LASERS
Energy-Level Transitions
CO_2 gamma 3 fundamental band 4.5 micrometers laser potential. Final report 2 May 1983-26 March 1984, 9:50393 (R;US)
Population Inversion
CO_2 gamma 3 fundamental band 4.5 micrometers laser potential. Final report 2 May 1983-26 March 1984, 9:50393 (R;US)
CARBON MONOXIDE
Adsorption
Structure determination of molecular adsorbates with dynamical LEED and HREELS, 9:50745 (R;US)
Monitoring
Health and environmental monitoring at the University of Minnesota-Duluth coal gasification facility. Draft, 9:49404 (R;US)
Phase Diagrams
New phases and chemical reactions in solid CO under pressure (15 to 300°K, 1.0 to 10.0 GPa), 9:50202 (R;US)
Standards
National air quality and emission trends report, 1982, 9:50531 (R;US)
CARBON OXIDE SULFIDE
See CARBON OXYSULFIDE
CARBON OXYSULFIDE
Absorption
Development of a hot gas cleanup system for integrated coal gasification/molten carbonate fuel cell power plants, 9:49341 (RA;US)
Equilibrium measurements for the absorption of H_2S, COS and HCl by alkali metal carbonates, 9:49368 (J;US)
Removal
Development of a hot gas cleanup system for integrated coal gasification/molten carbonate fuel cell power plants, 9:49341 (RA;US)
Metal/metal oxides as high temperature desulfurization sorbents, 9:49338 (RA;US)
CARBON STEELS
Corrosion
Gasification wastewater treatment and reuse, 9:49331 (RA;US)
Feasibility Studies
Corrosion studies on containment materials for vitrified high level nuclear waste. Annual progress report for 1983, 9:49532 (R;GB)
Welding
Measurement and calculation of the three-dimensional instationary temperature field in underwater welded plates, 9:50112 (R;DE;In German)
CARBONATE ROCKS
See also LIMESTONE
Lithology
Carbonate bodies within the basal swift formation (Jurassic) of northwestern North Dakota. Report of investigation No. 81, 9:50660 (R;US)
Spatial Distribution
Carbonate bodies within the basal swift formation (Jurassic) of northwestern North Dakota. Report of investigation No. 81, 9:50660 (R;US)
CARBONYL SULFIDE
See CARBON OXYSULFIDE
CARBONYLS
Only for compounds of metals with carbonyl radicals.
Catalytic Effects
Studies relevant to the catalytic activation of carbon monoxide: the water gas shift reaction and related processes. Technical progress report, December 1, 1983-November 30, 1984, 9:49330 (R;US)
CARBOXYLIC ACIDS
Labelling
Design and biological properties of iodine-123 labeled β-methyl-branched fatty acids, 9:50589 (R;US)
Synthesis
Design and biological properties of iodine-123 labeled β-methyl-branched fatty acids, 9:50589 (R;US)
CARBURETORS
Design
New knowledge in carburetor construction, 9:50072 (RA;DD;In German)

Performance
New knowledge in carburetor construction, 9:50072 (RA;DD;In German)

CARCINOGENESIS
Biological Models
Towards a molecular understanding of sunlight-induced skin cancer in mouse and man, 9:50602 (R;US)
Mathematical Models
Limited life-table factors for estimating radiation-induced cancers over finite time periods, 9:50619 (J;GB)
Meetings
Radiation research report, 9:50604 (R;US)
Reviews
Control of mutagenesis and cell differentiation in cultured human and rodent cells by chemicals that initiate or promote tumor formation, 9:50632 (R;US)
Risk Assessment
Limited life-table factors for estimating radiation-induced cancers over finite time periods, 9:50619 (J;GB)

CARCINOGENS
Carcinogenesis
Report on NCI symposium: comparison of mechanisms of carcinogenesis by radiation and chemical agents. II. Cellular and animal models, 9:50606 (R;US)

CARGO
Transport
Predictive intercity freight network models: The state-of-the-art, 9:50033 (J;GB)

CARPOOLING
Energy Conservation
Considering high occupancy vehicle alternatives in the urban transportation planning process: energy savings. Final report, August 1981-October 1983, 9:50029 (R;US)
Legal Incentives
Considering high occupancy vehicle alternatives in the urban transportation planning process: energy savings. Final report, August 1981-October 1983, 9:50029 (R;US)

CASCADE REACTORS
Design
Performance of the Cascade inertial-confinement-fusion conceptual reactor, 9:51037 (R;US)

CASCADE SHOWERS
Calculation Methods
Hadron-lepton cascade calculations (1-20 GeV) for a Pb-Al-lucite calorimeter, 9:50484 (R;US)

CASCADE SOLAR CELLS
Efficiency
High-efficiency multi-colored photovoltaic cells. Final report, 9:49623 (R;US)
Production
High-efficiency multi-colored photovoltaic cells. Final report, 9:49623 (R;US)

CASCADES (NUCLEAR)
See NUCLEAR CASCADES

CAST IRON
Erosion
Advanced Research and Technology Development Fossil Energy Materials Program. Quarterly progress report ending June 30, 1984, 9:50094 (R;US)

CASTING
Activation Analysis
Radioisotopic methods in metal founding, 9:50413 (RA;BG;In Bulgarian)
Tracer Techniques
Radioisotopic methods in metal founding, 9:50413 (RA;BG;In Bulgarian)

CATALYSTS
Comparative Evaluations
Hydrogen production from low-rank coals, 9:49332 (RA;US)
Deactivation
New and improved dispersion and recovery techniques for slurry phase catalysis. Quarterly report, October 1, 1983-December 31, 1983, 9:50299 (R;US)
New and improved dispersion and recovery techniques for slurry phase catalysis. Quarterly report, January-March, 1984, 9:49355 (R;US)
Performance Testing
Coal liquefaction in a synthoil reactor without added catalyst, 9:49374 (J;US)
Recycling
New and improved dispersion and recovery techniques for slurry phase catalysis. Quarterly report, January-March, 1984, 9:49355 (R;US)
Regeneration
New and improved dispersion and recovery techniques for slurry phase catalysis. Quarterly report, October 1, 1983-December 31, 1983, 9:50299 (R;US)
New and improved dispersion and recovery techniques for slurry phase catalysis. Quarterly report, January-March, 1984, 9:49355 (R;US)
Recovery of alkali metal constituents from catalytic coal conversion residues, 9:49363 (P;US)

CELL CYCLE
Kinetics
Effects of cellular non-protein sulfhydryl depletion in radiation induced oncogenic transformation and genotoxicity in mouse C_3H 10T1/2 cells, 9:50616 (J;US)
Paraquat and radiation effects on mouse C_3H 10T1/2 cells, 9:50617 (J;US)

CELL GROWTH (ANIMAL)
See ANIMAL CELLS

CELL KILLING
Radioinduction
Effects of cellular non-protein sulfhydryl depletion in radiation induced oncogenic transformation and genotoxicity in mouse C_3H 10T1/2 cells, 9:50616 (J;US)
Hypoxic cell sensitizers and heavy charged particle beams may play complementary roles in killing hypoxic tumor cells, 9:50618 (J;US)
Paraquat and radiation effects on mouse C_3H 10T1/2 cells, 9:50617 (J;US)

CELLS (ANIMAL)
See ANIMAL CELLS

CELLS (BACTERIAL)
See BACTERIA

CELLS (ELECTROLYTIC)
See ELECTROLYTIC CELLS

CENTER-OF-MASS SYSTEM
Transformations
Transformation of angular scattering probabilities between reference systems: survey and numerical analysis, 9:50827 (R;XN)

CENTRAL RECEIVER POWER PLANTS
See TOWER FOCUS POWER PLANTS

CENTRAL RECEIVERS
Design
Molten salt receiver subsystem research experiment: executive summary. Phase I, final report, 9:49674 (R;US)
Small Brayton central receiver systems for remote industrial power generation, 9:49676 (BA;US)
Molten Salts
Molten salt receiver subsystem research experiment: executive summary. Phase I, final report, 9:49674 (R;US)

CENTRAL REGION
See FEDERAL REGION III

CENTRE-OF-MASS SYSTEM
See CENTER-OF-MASS SYSTEM

CENTRIFUGE ENRICHMENT PLANTS
Safeguards
Internal safeguards for centrifuge enrichment plants. Concepts and procedures for safeguards and the international Hexapartite Safeguards Project (HSP), 9:49569 (R;DE;In German)

CERAMICS
Crystallization
Effect of crystallization of the grain-boundary phase on the thermal diffusivity of a sialon ceramic, 9:50167 (J;US)
Fabrication
Advanced Research and Technology Development Fossil Energy Materials Program. Quarterly progress report ending June 30, 1984, 9:50094 (R;US)

Research Programs
Metals and Ceramics Division progress report for period ending June 30, 1984, 9:50093 (R;US)
Thermal Diffusivity
Effect of crystallization of the grain-boundary phase on the thermal diffusivity of a sialon ceramic, 9:50167 (J;US)
Transmission Electron Microscopy
Transmission electron microscopy of inorganic materials, 9:50092 (R;US)

CERIUM
Absorption Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Activation Analysis
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Emission Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)

CERIUM 140 TARGET
Pion Minus Reactions
Dependence of the excitation energy, width, and cross section of the isovector monopole resonance, 9:50878 (J;FR)

CERMETS
Chemical Properties
Relations between material properties and performance of wear resistant materials, 9:50161 (R;DE;In German)
Mechanical Properties
Relations between material properties and performance of wear resistant materials, 9:50161 (R;DE;In German)
Physical Properties
Relations between material properties and performance of wear resistant materials, 9:50161 (R;DE;In German)
Wear Resistance
Relations between material properties and performance of wear resistant materials, 9:50161 (R;DE;In German)

CESIUM
Absorption Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Activation Analysis
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Electronic Structure
Calorimetric investigation into the possibility of a charge density wave ground state in alkali metals, 9:50133 (R;US)
Emission Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Photoionization
Effects of dc electric fields on multiphoton ionization spectra in cesium, 9:50726 (R;US)
Multiphoton ionization of atomic cesium, 9:50721 (R;US)
Multiphoton ionization of cesium atoms above and below the two-photon ionization threshold, 9:50719 (R;US)
Specific Heat
Calorimetric investigation into the possibility of a charge density wave ground state in alkali metals, 9:50133 (R;US)

CESIUM 137
Radioecological Concentration
Gamma-ray emitting radionuclides in environmental samples from the South-West Bulgaria, 9:50558 (RA;BG;In Bulgarian)
Joint comparative research on gamma-ray emitting radionuclides in samples from the Danube-Black Sea territorial complex, 9:50559 (RA;BG;In Bulgarian)

CHALKS
See LIMESTONE

CHANNELING
See also ELECTRON CHANNELING
ION CHANNELING
PROTON CHANNELING
Temperature Effects
Accounting for temperature dependence at description and simulation of axial channeling, 9:50948 (RA;SU;In Russian)
Trajectories
Peculiarities of two-dimensional particle motion at axial channeling, 9:50949 (RA;SU;In Russian)

CHANNELS (REACTOR)
See REACTOR CHANNELS

CHARGED PARTICLES
In addition to the specific charged particles listed below, see also the list under ELEMENTARY PARTICLES.
See also IONS
Motion
Particles in spherical electromagnetic radiation fields, 9:50970 (R;AT)
Scattering
Particles in spherical electromagnetic radiation fields, 9:50970 (R;AT)

CHARGED-PARTICLE ACTIVATION
See ACTIVATION ANALYSIS
CHARGED PARTICLES

CHARGED-PARTICLE TRANSPORT
Computer Codes
Monte Carlo simulation of electron/photon/Cherenkov cascades in generalized geometry, 9:50934 (J;US)
Computerized Simulation
Monte Carlo simulation of electron/photon/Cherenkov cascades in generalized geometry, 9:50934 (J;US)
Finite Difference Method
Computational study of discretization error for the upwind finite-difference approximation to the Spencer-Lewis equation, 9:50932 (J;US)
Radiation Streaming
Simulating electron energy loss fluctuations in deterministic streaming ray calculations, 9:50933 (J;US)

CHARGE-EXCHANGE REACTIONS
Giant Resonance
Comment on '(p,n) and (n,p) reactions as probes of isovector giant monopole resonances', 9:50917 (R;AU)

CHARMED BARYON RESONANCES
Photoproduction
Charm photoproduction at 20 GeV, 9:50770 (R;GB)

CHARMED MESON RESONANCES
See also D RESONANCES
Lifetime
Charm photoproduction at 20 GeV, 9:50770 (R;GB)
Photoproduction
Charm photoproduction at 20 GeV, 9:50770 (R;GB)

CHATTANOOGA FORMATION
See also BLACK SHALES
Geochemistry
Physiochemical characterization of the Devonian Chattanooga Shale in North Alabama and South-Central Tennessee, 9:49502 (BA;US)

CHEMICAL ANALYSIS
See also ACTIVATION ANALYSIS
NUCLEAR REACTION ANALYSIS
Meetings
Twenty-seventh ORNL/DOE conference on analytical chemistry in energy technology: abstracts, 9:50258 (R;US)
Training
Matrix scientist in a matrix organization, 9:50261 (R;US)

CHEMICAL EFFLUENTS
Information Systems
EADS (Environmental Assessment Data Systems) Liquid Effluents Data System, 1982. Annual report, 9:50571 (R;US)

CHEMICAL EXPLOSIVES
Accidents
Explosive safety criteria at a Department of Energy contractor facility, 9:50419 (R;US)
Safety Engineering
Explosive safety criteria at a Department of Energy contractor facility, 9:50419 (R;US)
Safety Standards
Explosive safety criteria at a Department of Energy contractor facility, 9:50419 (R;US)

CHEMICAL REACTORS
See also RETORTS
Air Flow
Air-flow regulation system for a coal gasifier, 9:49365 (P;US)

Design
Development of an advanced water-gas shift conversion system. Monthly project status report No. 6, September 1-30, 1984, 9:49357 (R;US)
Experimental and theoretical study of a solar thermochemical receiver module, 9:49666 (R;US)
Operation
Development of an advanced water-gas shift conversion system. Monthly project status report No. 6, September 1-30, 1984, 9:49357 (R;US)

CHEMICALS
See CARCINOGENS
DYES
PIGMENTS
SOLVENTS

CHEMISTRY
See also ATMOSPHERIC CHEMISTRY
GEOCHEMISTRY
NUCLEAR CHEMISTRY
Research Programs
Department of Chemistry of the Austrian Research Centre Seibersdorf, 9:50257 (R;AT;In German)
Summaries of FY 1984 research in the chemical sciences, 9:50256 (R;US)

CHERENKOV COUNTERS
Cerenkov detector for heavy-ion velocity measurements, 9:50482 (R;US)

CHERENKOV DETECTORS
See CHERENKOV COUNTERS

CHINESE HAMSTER OVARY CELLS
See CHO CELLS

CHIRAL SYMMETRY
U-1 Groups
Chiral symmetry and the U(1) problem, 9:50795 (RA;AU)

CHLOR-ALKALI INDUSTRY
See CHLORINE
SODIUM CARBONATES

CHLORINE
Activation Analysis
Neutron activation analysis on a series of human gallstones, 9:50272 (RA;AU)
Proton Microprobe Analysis
Elemental microanalysis of individual blood cells, 9:50277 (RA;AU)
Water Chemistry
Chemistry and fate of disinfection by-products, 9:50568 (R;US)

CHLORINE 37 TARGET
Proton Reactions
Proton induced reactions on ^{37}Cl and their relevance to nucleosynthesis, 9:50853 (RA;AU)

CHLORINE 40
Mass
Studies of very neutron-rich light nuclei using a gas target, 9:50860 (RA;AU)

CHLORINE 41
Mass
Studies of very neutron-rich light nuclei using a gas target, 9:50860 (RA;AU)

CHLORINE CHLORIDES
See CHLORINE

CHLORINS
Excitation
Spectral properties of protonated Schiff base porphyrins and chlorins. INDO-CI calculations and resonance raman studies, 9:50337 (J;US)
Structural Chemical Analysis
Spectral properties of protonated Schiff base porphyrins and chlorins. INDO-CI calculations and resonance raman studies, 9:50337 (J;US)

CHO CELLS
Gene Mutations
Mutagenic activity of nitrosamines in mammalian cells: Study with the CHO/HGPRT and human leukocyte SCE assays, 9:50642 (BA;US)

CHROMIUM
Absorption Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Activation Analysis
Problems of chromium determination in biological materials, 9:50269 (RA;CS;In Czech)
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Emission Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Energy-Level Density
Edge states and quantized Hall conductivity in a periodic potential, 9:50144 (J;US)
Fermi Level
Edge states and quantized Hall conductivity in a periodic potential, 9:50144 (J;US)
Soil Chemistry
Attenuation of chemical elements in acidic leachates from coal mineral wastes by soils, 9:49407 (R;US)
Work Functions
Edge states and quantized Hall conductivity in a periodic potential, 9:50144 (J;US)

CHROMIUM 52 TARGET
Alpha Reactions
Dynamic density dependence of the alpha-nucleon force in folding models of inelastic scattering of alpha-particles, 9:50865 (R;DE)

CHROMIUM ALLOYS
See also ALLOY-IN-100
ALLOY-IN-939
STAINLESS STEELS
Physical Radiation Effects
Experimental determination of the critical cavity radius in Fe-10% Cr for ion irradiation, 9:50098 (R;US)

CHROMIUM-MOLYBDENUM STEELS
Aging
Toughness behaviour of the steel X 20 CrMoV 12 1. Results of optimizing the base- and weld metal, 9:50118 (RA;DE)
Fabrication
State of the development and applications-techniques of the steel X 20 CrMoV 12 1, 9:50115 (RA;DE;In German)
Fracture Properties
Proof of the fracture resistance of the pipes in the THTR 300 plant using high temperature burst tests with X 20 CrMoV 12 1 components, 9:50117 (RA;DE;In German)
Toughness behaviour of the steel X 20 CrMoV 12 1. Results of optimizing the base- and weld metal, 9:50118 (RA;DE)
Heat Treatments
Advanced Research and Technology Development Fossil Energy Materials Program. Quarterly progress report ending June 30, 1984, 9:50094 (R;US)
Mechanical Properties
State of the development and applications-techniques of the steel X 20 CrMoV 12 1, 9:50115 (RA;DE;In German)
Welding
Advanced Research and Technology Development Fossil Energy Materials Program. Quarterly progress report ending June 30, 1984, 9:50094 (R;US)

CHROMODYNAMICS
See QUANTUM CHROMODYNAMICS

CIRCULAR POINT COLLECTORS
See PARABOLIC DISH COLLECTORS

CLADDING-FUEL INTERACTIONS
See FUEL-CLADDING INTERACTIONS

CLAYS
Thermal Conductivity
Geologic disposal of radioactive waste. An in situ heating experiment in clay rock, 9:49550 (R;IT;In Italian)
Thermal Diffusion
Geologic disposal of radioactive waste. An in situ heating experiment in clay rock, 9:49550 (R;IT;In Italian)

CLEAN AIR ACT
Amendments
Acid rain control (Part 2). Hearings before the Subcommittee on Health and the Environment of the Committee on Energy and Commerce, House of Representatives, Ninety-Eighth Congress, Second Session on H.R. 3400, February 17 and March 5, 1984, 9:50544 (B;US)

Political Aspects
Discussion of policy issues in implementing environmental legislation, 9:49927 (R;US)
CLEAN WATER ACT
Prior to April 1980, FEDERAL WATER POLLUTION CONTROL ACT was used to index this concept.
Political Aspects
Discussion of policy issues in implementing environmental legislation, 9:49927 (R;US)
CLINTON P. ANDERSON MESON PHYSICS FACILIT
See LAMPF LINAC
CLUSTERS (FUEL ELEMENTS)
See FUEL ELEMENT CLUSTERS
CO2 FLOODING
See CARBON DIOXIDE INJECTION
COAL
See also BROWN COAL
SUBBITUMINOUS COAL
Calorific Value
Ultra-fine coal characterization. 2nd quarterly report, June 1, 1984-August 31, 1984, 9:49383 (R;US)
Chemical Composition
Mercury species present in smoke from coal fire. Water soluble mercury species in air and precipitation, 9:50530 (R;SE;In Swedish)
Ultra-fine coal characterization. 2nd quarterly report, June 1, 1984-August 31, 1984, 9:49383 (R;US)
Chemical Properties
Dependence of liquefaction behavior on coal characteristics. Part VI. Relationship of liquefaction behavior of a set of high sulfur coals to chemical structural characteristics. Final technical report, March 1981 to February 1984 , 9:49352 (R;US)
Chemical Reactions
Influence of redox and Lewis acid functions of $SbCl_3$-rich molten salt catalysts on the reactions of coal model compounds, 9:50326 (J;US)
Combustion
Small coal furnaces: the neglected option, 9:49425 (RA;US)
Stoker test evaluations using clean pellet fuel, 9:49433 (R;US)
Combustion Products
Chemical effects of entrained particles in coal conversion streams: prediction of PFBC alkali levels, 9:49432 (RA;US)
Performance of an electrostatic precipitator at simulated PFBC conditions, 9:49755 (RA;US)
Some recent progress in acoustic agglomeration of power plant fly ash, 9:49756 (RA;US)
Comparative Evaluations
Fine coal cleaning, 9:49422 (RA;US)
Deashing
Pilot Plant Program for the AED Advanced Coal Cleaning System. Phase II. Interim final report, 9:49423 (R;US)
Desulfurization
Pilot Plant Program for the AED Advanced Coal Cleaning System. Phase II. Interim final report, 9:49423 (R;US)
Devolatilization
Pyrolysis and devolatilization, 9:49335 (RA;US)
Dielectric Properties
Physical properties and moisture, 9:49381 (RA;US)
Drying
Entrainment/elutriation in fluidization and application in drying coal (Fluidized bed), 9:49420 (R;US)
Exports
How rapidly can production and use of eastern coal be expanded (USA; 1973-1982), 9:49411 (RA;US)
Prospects for coal in America's energy future (USA: 1982 to 2000), 9:49413 (R;US)
Fluidized-Bed Combustion
Chemical effects of entrained particles in coal conversion streams: prediction of PFBC alkali levels, 9:49432 (RA;US)
Fluidization 1980 conference: [summary of workshop discussions], 9:49426 (R;US)
Hot gas cleanup using porous ceramic cross flow filters, 9:49394 (RA;US)
Testing and verification of granular bed filters for removal of particulates and alkalis, 9:49389 (RA;US)
Fuel Consumption
Annual outlook for US coal, 1984: with projections to 1995, 9:49436 (R;US)
Functional Models
Influence of redox and Lewis acid functions of $SbCl_3$-rich molten salt catalysts on the reactions of coal model compounds, 9:50326 (J;US)
Grinding
Ultra-fine coal characterization. 2nd quarterly report, June 1, 1984-August 31, 1984, 9:49383 (R;US)
Hydraulic Transport
Slurry pipeline cost analysis computer program, 9:49418 (R;GB)
Leachates
Attenuation of chemical elements in acidic leachates from coal mineral wastes by soils, 9:49407 (R;US)
Leaching
Studies on the leaching and weathering processes of coal ashes, 9:49398 (R;SE;In Swedish)
Losses
Pilot Plant Program for the AED Advanced Coal Cleaning System. Phase II. Interim final report, 9:49423 (R;US)
Mineralogy
Ultra-fine coal characterization. 2nd quarterly report, June 1, 1984-August 31, 1984, 9:49383 (R;US)
Pelletizing
Stoker test evaluations using clean pellet fuel, 9:49433 (R;US)
Physical Properties
Dependence of liquefaction behavior on coal characteristics. Part VI. Relationship of liquefaction behavior of a set of high sulfur coals to chemical structural characteristics. Final technical report, March 1981 to February 1984 , 9:49352 (R;US)
Physical properties and moisture, 9:49381 (RA;US)
Prices
How rapidly can production and use of eastern coal be expanded (USA; 1973-1982), 9:49411 (RA;US)
Prospects for coal in America's energy future (USA: 1982 to 2000), 9:49413 (R;US)
State Energy Price System: 1982 update, 9:49952 (R;US)
Production
Annual outlook for US coal, 1984: with projections to 1995, 9:49436 (R;US)
Coal distribution, January-June 1984, 9:49435 (R;US)
How rapidly can production and use of eastern coal be expanded (USA; 1973-1982), 9:49411 (RA;US)
Prospects for coal in America's energy future (USA: 1982 to 2000), 9:49413 (R;US)
Pyrolysis
Pyrolysis and devolatilization, 9:49335 (RA;US)
Sample Preparation
Premium Coal Sample Program: a model, 9:49376 (R;US)
Sampling
Premium Coal Sample Program: a model, 9:49376 (R;US)
Solid Wastes
Assessment of research and development for the management of fossil energy-related solid wastes, 9:49399 (R;US)
Supercritical Gas Extraction
Supercritical solvent extraction, 9:49334 (RA;US)
Swelling
Ultra-fine coal characterization. 2nd quarterly report, June 1, 1984-August 31, 1984, 9:49383 (R;US)
Transport
Coal distribution, January-June 1984, 9:49435 (R;US)
Weathering
Studies on the leaching and weathering processes of coal ashes, 9:49398 (R;SE;In Swedish)
COAL DEPOSITS
See also COAL SEAMS
Directional Drilling
Feasibility study: vertical fracturing in directionally drilled wells. Final report, January 1983-September 1983, 9:49482 (R;US)

Hydraulic Fracturing
Feasibility study: vertical fracturing in directionally drilled wells. Final report, January 1983-September 1983, 9:49482 (R;US)
Leasing
Legislative changes are needed to authorize emergency federal coal leasing, 9:49437 (R;US)

COAL FINES
Comminution
Fine coal cleaning, 9:49422 (RA;US)
Moisture
Microwave moisture-meter, 9:49419 (R;DE;In German)
Particle Size
Ultra-fine coal characterization. 2nd quarterly report, June 1, 1984-August 31, 1984, 9:49383 (R;US)
Washing
Fine coal cleaning, 9:49422 (RA;US)
Ultra-fine coal characterization. 2nd quarterly report, June 1, 1984-August 31, 1984, 9:49383 (R;US)

COAL GASIFICATION
See also GKT PROCESS
LURGI PROCESS
Catalysis
Catalytic coal gasification (146 references), 9:49359 (R;GB)
Catalysts
Hydrogen production from low-rank coals, 9:49332 (RA;US)
Method for the preparation of a gaseous fuel, 9:49369 (TG;GB)
Chemical Reaction Kinetics
Catalytic coal gasification (146 references), 9:49359 (R;GB)
Environmental Impacts
Comments on coal conversion program, 9:49371 (BA;US)
Heat Exchangers
Heat exchanger for coal gasification process, 9:49364 (P;US)
Hot Gas Cleanup
High-temperature removal of alkali vapors in hot-gas cleaning systems, 9:49343 (RA;US)
Materials Recovery
Recovery of alkali metal constituents from catalytic coal conversion residues, 9:49363 (P;US)
Meetings
Properties and performance of materials in the coal gasification environment, 9:49370 (B;US)
Reviews
Catalytic coal gasification (146 references), 9:49359 (R;GB)
Solid Wastes
Assessment of research and development for the management of fossil energy-related solid wastes, 9:49399 (R;US)
Technology Assessment
Status and overview of surface coal gasification, 9:49337 (RA;US)

COAL GASIFICATION PLANTS
Acoustic Testing
State-of-the-art review of acoustic techniques for application to the nondestructive evaluation of refractory concrete for coal gasification, 9:49329 (R;US)
Hot Gas Cleanup
Design and development of a high temperature particle separator for particle control in coal gasification plants, 9:49344 (RA;US)
Liners
State-of-the-art review of acoustic techniques for application to the nondestructive evaluation of refractory concrete for coal gasification, 9:49329 (R;US)
Materials
Advanced Research and Technology Development Fossil Energy Materials Program. Quarterly progress report ending June 30, 1984, 9:50094 (R;US)
Properties and performance of materials in the coal gasification environment, 9:49370 (B;US)
Monitoring
Health and environmental monitoring at the University of Minnesota-Duluth coal gasification facility. Draft, 9:49404 (R;US)
Waste Water
Gasification wastewater treatment and reuse, 9:49331 (RA;US)
Proceedings of the third biennial synfuels wastewater workshop, 9:49387 (R;US)
Sour water stripping of coal gasification waste water. Final report, 9:49386 (R;US)
Windows
Purged window apparatus utilizing heated purge gas, 9:49366 (P;US)

COAL INDUSTRY
Data Compilation
Coal distribution, January-June 1984, 9:49435 (R;US)
Financial Incentives
Post-war energy economics: the urban and regional implications, 9:49921 (RA;US)
Investment
How rapidly can production and use of eastern coal be expanded, 9:49411 (RA;US)
Labor Relations
How rapidly can production and use of eastern coal be expanded, 9:49411 (RA;US)

COAL LIQUEFACTION
See also SRC-II PROCESS
SYNTHOIL PROCESS
TSL PROCESS
Environmental Impacts
Fossil Energy Technology Environmental Program information system: making the data accessible, 9:49405 (R;US)
Information Systems
Fossil Energy Technology Environmental Program information system: making the data accessible, 9:49405 (R;US)
Solid Wastes
Assessment of research and development for the management of fossil energy-related solid wastes, 9:49399 (R;US)
Yields
Dependence of liquefaction behavior on coal characteristics. Part VI. Relationship of liquefaction behavior of a set of high sulfur coals to chemical structural characteristics. Final technical report, March 1981 to February 1984 , 9:49352 (R;US)

COAL LIQUEFACTION PLANTS
Design
Process design and economic evaluation of a conceptual 100,000 bbl/day synthoil plant, 9:49373 (J;US)
Economic Analysis
Process design and economic evaluation of a conceptual 100,000 bbl/day synthoil plant, 9:49373 (J;US)
Materials
Advanced Research and Technology Development Fossil Energy Materials Program. Quarterly progress report ending June 30, 1984, 9:50094 (R;US)
Waste Water
Proceedings of the third biennial synfuels wastewater workshop, 9:49387 (R;US)

COAL LIQUIDS
Carcinogen Screening
Mutagenicity and carcinogenicity of polycyclic aromatic enriched fractions from coal liquefaction materials, 9:50637 (R;US)
Cost
Process design and economic evaluation of a conceptual 100,000 bbl/day synthoil plant, 9:49373 (J;US)
Deashing
Nonintegrated two-stage coal liquefaction: the Wilsonville Advanced Coal Liquefaction R and D Facility, Wilsonville, Alabama. Final report, 9:49358 (R;US)
Desulfurization
Nonintegrated two-stage coal liquefaction: the Wilsonville Advanced Coal Liquefaction R and D Facility, Wilsonville, Alabama. Final report, 9:49358 (R;US)
Fractionation
Low-rank coal liquefaction, 9:49333 (RA;US)
Gas Chromatography
Low-rank coal liquefaction, 9:49333 (RA;US)
Gel Permeation Chromatography
Synthesis of oligomeric models of coal derived materials for use with GPC calibration. Quarterly report, June 1984-September 1984, 9:49353 (R;US)

Hydrogenation
New and improved dispersion and recovery techniques for slurry phase catalysis. Quarterly report, January-March, 1984, 9:49355 (R;US)
Nonintegrated two-stage coal liquefaction: the Wilsonville Advanced Coal Liquefaction R and D Facility, Wilsonville, Alabama. Final report, 9:49358 (R;US)
Liquid Column Chromatography
Low-rank coal liquefaction, 9:49333 (RA;US)
Mutagen Screening
Mutagenicity and carcinogenicity of polycyclic aromatic enriched fractions from coal liquefaction materials, 9:50637 (R;US)
Physical Properties
Coal liquefaction in a synthoil reactor without added catalyst, 9:49374 (J;US)
Recycling
Nonintegrated two-stage coal liquefaction: the Wilsonville Advanced Coal Liquefaction R and D Facility, Wilsonville, Alabama. Final report, 9:49358 (R;US)
Viscosity
Low-rank coal liquefaction, 9:49333 (RA;US)

COAL MINERS
Productivity
How rapidly can production and use of eastern coal be expanded, 9:49411 (RA;US)

COAL PREPARATION
Electrostatics
Pilot Plant Program for the AED Advanced Coal Cleaning System. Phase II. Interim final report, 9:49423 (R;US)
Pilot Plants
Pilot Plant Program for the AED Advanced Coal Cleaning System. Phase II. Interim final report, 9:49423 (R;US)

COAL PREPARATION PLANTS
Materials
Advanced Research and Technology Development Fossil Energy Materials Program. Quarterly progress report ending June 30, 1984, 9:50094 (R;US)
Moisture Gages
Microwave moisture-meter, 9:49419 (R;DE;In German)
On-Line Measurement Systems
Microwave moisture-meter, 9:49419 (R;DE;In German)

COAL RANK
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COAL SEAMS
Calorific Value
Ultra-fine coal characterization. 2nd quarterly report, June 1, 1984-August 31, 1984, 9:49383 (R;US)
Chemical Composition
Ultra-fine coal characterization. 2nd quarterly report, June 1, 1984-August 31, 1984, 9:49383 (R;US)
Sampling
Water jet cutting of coal, 9:49409 (R;GB)
Swelling
Ultra-fine coal characterization. 2nd quarterly report, June 1, 1984-August 31, 1984, 9:49383 (R;US)

COAL-DERIVED LIQUIDS
See COAL LIQUIDS

COAL-OIL MIXTURES
See COAL
FUEL OILS
FUEL SLURRIES

COALTEK PROCESS
See FUEL FEEDING SYSTEMS

COASTAL ZONE MANAGEMENT ACT
Consistency: current issues (Consistency determinations under the Coastal Zone Management Act), 9:49468 (R;US)

COATINGS
See also ANTIREFLECTION COATINGS
PAINTS
PROTECTIVE COATINGS
REFLECTIVE COATINGS
Stresses
Process-included topological changes of monocrystalline silicon plates, 9:50205 (R;DE;In German)

COBALT
Absorption Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Activation Analysis
Neutron activation analysis on a series of human gallstones, 9:50272 (RA;AU)
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Catalytic Effects
Catalysts for gasification of biomass, 9:49586 (R;US)
Metal-zeolite catalysts for the conversion of synthesis gas to selected hydrocarbon products, 9:49582 (BA;US)
Emission Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Soil Chemistry
Attenuation of chemical elements in acidic leachates from coal mineral wastes by soils, 9:49407 (R;US)

COBALT 60
Uses
Wear measurements of cutting tools made of hard metal, 9:49573 (R;AT;In German)

COBALT ALLOYS
See also ALLOY-IN-100
ALLOY-IN-939
COBALT BASE ALLOYS
INCONEL 738
Fabrication
Design of ordered intermetallic alloys for high-temperature structural use (Ni_3V-CO_3V-Fe_3V; Ni_3Al), 9:50096 (R;US)
Grain Growth
Investigation of the growth kinetics of metal carbide systems (WC-Co; TiC-Co; TiC-Ni), 9:50170 (TJ;US)
Mechanical Properties
Design of ordered intermetallic alloys for high-temperature structural use (Ni_3V-CO_3V-Fe_3V; Ni_3Al), 9:50096 (R;US)

COBALT BASE ALLOYS
Corrosion
Static and dynamic strength of gas turbine blade material under conditions of high temperature corrosion, 9:50136 (R;DE;In German)
Creep
Static and dynamic strength of gas turbine blade material under conditions of high temperature corrosion, 9:50136 (R;DE;In German)
Fatigue
Static and dynamic strength of gas turbine blade material under conditions of high temperature corrosion, 9:50136 (R;DE;In German)
Tensile Properties
Static and dynamic strength of gas turbine blade material under conditions of high temperature corrosion, 9:50136 (R;DE;In German)

COBALT CHLORIDES
Magnetic Properties
Observation of a disordered spin-flop phase in Fe/sub 0.725/Co/sub 0.275/Cl_2, 9:50308 (J;US)
Phase Diagrams
Observation of a disordered spin-flop phase in Fe/sub 0.725/Co/sub 0.275/Cl_2, 9:50308 (J;US)

COBALT COMPLEXES
Chemical Reaction Kinetics
Ground- and excited-state electron-transfer reactions: photoinduced redox reactions of poly(pyridine)ruthenium(II) complexes and cobalt(III) cage compounds, 9:50336 (J;US)
Chemical Reactions
Reactions of $FeCH_3^+$ and $CoCH_3^+$ with aliphatic alkanes in the gas phase, 9:50322 (J;US)
Reactions of $FeCH_3^+$ and $CoCH_3^+$ with cyclic hydrocarbons in the gas phase, 9:50323 (J;US)
Redox Reactions
Ground- and excited-state electron-transfer reactions: photoinduced redox reactions of poly(pyridine)ruthenium(II) complexes and cobalt(III) cage compounds, 9:50336 (J;US)

Structural Chemical Analysis
Reactions of $FeCH_3^+$ and $CoCH_3^+$ with aliphatic alkanes in the gas phase, 9:50322 (J;US)
Reactions of $FeCH_3^+$ and $CoCH_3^+$ with cyclic hydrocarbons in the gas phase, 9:50323 (J;US)

COGENERATION
Prior to November 1980, this concept was indexed to CO-GENERATION.
See COGENERATION

Computerized Simulation
Cogeneration computer model assessment: advanced cogeneration research study, 9:49940 (R;US)

Control Systems
Development of an advanced, microprocessor-based control subsystem for gas-fired, packaged cogeneration systems. Annual report February 1983-February 1984, 9:50059 (R;US)

Economic Analysis
Advanced cogeneration research study. Executive summary, 9:49939 (R;US)

Manuals
Ohio cogeneration handbook, 9:50056 (R;US)

Mathematical Models
Cogeneration computer model assessment: advanced cogeneration research study, 9:49940 (R;US)

Technology Assessment
Assessment of advanced technology for industrial cogeneration, 9:49938 (R;US)
Survey of cogeneration: advanced cogeneration research study, 9:49941 (R;US)

COHERENT ACCELERATORS

Proton Beams
Proton laser accelerator by means of the inverse free electron laser mechanism, 9:50442 (R;US)

COILS (MAGNETIC)
See MAGNET COILS

COKE

Calcination
Calciner unit SRC-I Coal Refinery, Newman, Kentucky: design baseline. Revision 1, 9:49348 (R;US)

Storage Facilities
Calciner unit SRC-I Coal Refinery, Newman, Kentucky: design baseline. Revision 1, 9:49348 (R;US)

COLLECTIVE ACCELERATORS

Simulation
Collective ion acceleration by a reflexing electron beam: model and scaling. Memorandum report, 9:50450 (R;US)

COLLOIDS
See also FOAMS

Suspensions
Light scattering studies of lower dimensional colloidal particle and critical fluid systems, 9:50317 (R;US)

COLOGNE SPIRITS
See ETHANOL

COLORADO

Natural Gas Deposits
Model for fracture genesis: application to Mesaverde group, Piceance Creek basin, Colorado, 9:49476 (J;US)

Petroleum Deposits
Facies relationships and reservoir potential of Ohio Creek interval across Piceance Creek basin, northwestern Colorado, 9:49445 (J;US)

Sedimentary Basins
Model for fracture genesis: application to Mesaverde group, Piceance Creek basin, Colorado, 9:49476 (J;US)

Solar Energy
Testing and computer simulation of an air based, solar assisted heat pump system, 9:49701 (BA;US)

COLUMBIUM
See NIOBIUM

COMBINED GAS AND STEAM CYCLE POWER PLANTS
See COMBINED-CYCLE POWER PLANTS

COMBINED STEAM-POWER GENERATION
See COGENERATION

COMBINED-CYCLE POWER PLANTS
Prior to March, 1976, the descriptors COMBINED CYCLES and FOSSIL-FUEL POWER PLANTS or THERMAL POWER PLANTS were used for indexing this concept.

Coal Gasification
Coal combined cycle system study. Volume III. Concept descriptions, 9:49749 (R;US)

Economic Analysis
Coal combined cycle system study. Volume III. Concept descriptions, 9:49749 (R;US)

Fluidized Bed
Coal combined cycle system study. Volume III. Concept descriptions, 9:49749 (R;US)

COMBUSTION PRODUCTS

Chemical Composition
Mercury species present in smoke from coal fire. Water soluble mercury species in air and precipitation, 9:50530 (R;SE;In Swedish)

Chemistry
Chemical effects of entrained particles in coal conversion streams: prediction of PFBC alkali levels, 9:49432 (RA;US)

Flue Gas
Mercury species present in smoke from coal fire. Water soluble mercury species in air and precipitation, 9:50530 (R;SE;In Swedish)

Health Hazards
Health and Environmental Risk Analysis Program workshop: potential public health impacts of airborne organic combustion products, 9:50521 (R;US)

Hot Gas Cleanup
Alkali removal from hot combustion gases by adsorption on submicron-size particles, 9:49393 (RA;US)
Chemical effects of entrained particles in coal conversion streams: prediction of PFBC alkali levels, 9:49432 (RA;US)
Contaminant control in hot coal derived gas streams: proceedings, 9:49388 (R;US)
Dust filtration using ceramic fiber filter media: a state-of-the-art summary, 9:49395 (RA;US)
Hot gas cleanup using porous ceramic cross flow filters, 9:49394 (RA;US)
Performance of an electrostatic precipitator at simulated PFBC conditions, 9:49755 (RA;US)
Testing and verification of granular bed filters for removal of particulates and alkalis, 9:49389 (RA;US)

COMETS

Chemical Composition
Chemical and isotopic measurements of micrometeoroids by secondary ion mass spectrometry (A0187-2), 9:50680 (R;US)

Isotope Ratio
Chemical and isotopic measurements of micrometeoroids by secondary ion mass spectrometry (A0187-2), 9:50680 (R;US)

COMMERCIAL BUILDINGS

Energy Conservation
Determinants of interest in new energy reduction projects among commercial and industrial ratepayers, 9:49993 (RA;US)
Specification and cost manual for energy retrofits on small commercial and multifamily buildings, 9:49690 (R;US)
Stimulating energy conservation in commercial buildings: A simulation analysis of alternative policies, 9:50027 (J;GB)
Utility financing of energy management: the Puget Sound Power and Light experience, 9:49986 (RA;US)

Energy Policy
Stimulating energy conservation in commercial buildings: A simulation analysis of alternative policies, 9:50027 (J;GB)

Manuals
Specification and cost manual for energy retrofits on small commercial and multifamily buildings, 9:49690 (R;US)

COMMERCIAL SECTOR

Energy Audits
EnergyCHECK commercial/industrial energy audit program, 9:50049 (RA;US)

Energy Consumption
Adapting state and national electricity consumption forecasting methods to utility service areas. Final report, 9:49956 (R;US)

Energy Expenses
Appendices A, B, and C of the methodology for life cycle cost analysis using average fuel costs, 9:49955 (R;US)

COMMUNITIES
Energy Conservation
Development of a community energy conservation program. Guide to organizing and managing a program. Volume I, 9:50065 (R;US)
COMPACT COMMISSIONS
Administrative Procedures
Commission administration. National Low-Level Radioactive Waste Management Program, 9:49545 (R;US)
Enforcement
Commission enforcement. National Low-Level Radioactive Waste Management Program, 9:49547 (R;US)
Operation
Commission operation. National Low-Level Radioactive Waste Management Program, 9:49546 (R;US)
COMPACT TORUS
Prior to October 1982, this concept was indexed to THERMONUCLEAR DEVICES or to a particular experiment if known, e.g., REVERSE-FIELD PINCH.
Mathematical Models
Theoretical investigations relevant to magnetic fusion research, 9:51003 (R;US)
COMPOSITE MATERIALS
See also CERMETS
Fabrication
Fabrication of SiC whiskers and composites, 9:50174 (R;US)
Mechanical Properties
Advanced Research and Technology Development Fossil Energy Materials Program. Quarterly progress report ending June 30, 1984, 9:50094 (R;US)
Ultrasonic Testing
Ultrasonic analysis of spherical composite test specimens, 9:50416 (R;US)
COMPOSITE MODELS
Symmetry Breaking
Chiral-symmetry breaking in a composite model with scalars based on lattice gauge theory, 9:50809 (J;US)
COMPOUND NUCLEI
Lifetime
Fission lifetimes from blocking measurements: ^{19}F bombardment of a thin tantalum crystal, 9:50892 (RA;SU)
Use of total shadow profiles for obtaining the information on compounds nuclei lifetime, 9:50854 (RA;SU;In Russian)
Shadow Effect
Use of total shadow profiles for obtaining the information on compounds nuclei lifetime, 9:50854 (RA;SU;In Russian)
COMPOUND-NUCLEUS REACTIONS
Breit-Wigner Formula
Pauli-corrected Breit-Wigner formulae for compounds resonances in two- and three-cluster systems, 9:50922 (J;IT)
COMPOUNDS (ORGANIC)
See ORGANIC COMPOUNDS
COMPRESSED AIR ENERGY STORAGE
Outcome of compressed air energy storage at Pittsfield, Illinois, 9:49904 (R;US)
COMPUTER CODES
Computer codes are indexed by their initial letter and CODES, e.g., A CODES. If the code name begins with a number the code is indexed to NUMBER CODES.
Program for TI programmable 59 calculator for calculation of ^{3}H concentration of water samples, 9:50351 (R;PK)
A Codes
Monte Carlo simulation of electron/photon/Cherenkov cascades in generalized geometry, 9:50934 (J;US)
B Codes
Austrian contributions to fuel rod failure models shown at the International Standard Problem ISP-14 (BALON-2A code), 9:49896 (R;AT;In German)
BIOMOD - preliminary findings, 9:49537 (R;GB)
Development of the biosphere code BIOMOD: final report, 9:49535 (R;GB)
User's guide to the biosphere code BIOMOD, 9:49534 (R;GB)
C Codes
CONTING Program Guide, 9:49765 (R;US)
D Codes
Method for convergence acceleration of iterative solutions of eigenvalue-problems in reactor theory and implementation in the DIFGEN-code, 9:49798 (R;DE;In German)
G Codes
Computer code for general analysis of radon risks (GARR), 9:50615 (R;US)
GT2R2: an updated version of GAPCON-THERMAL-2, 9:49816 (R;US)
K Codes
KANDY - a numerical model to describe phenomena, which - in a heated and voided fuel element of an LMFBR - may occur, 9:49882 (R;DE;In German)
M Codes
MARCH 2 (Meltdown Accident Response Characteristics) code description and user's manual, 9:49894 (R;US)
Optimization of flat and horizontally curved neutron monochromators for given diffractometer geometries, 9:50928 (R;DE)
User's guide to MIX: a computer code for fitting mixture distributions to data, 9:51051 (R;US)
Manuals
User's guide for QPSOL (Version 3.2): a Fortran package for quadratic programming, 9:51062 (R;US)
N Codes
NIDAC - an on-line program for measurement and anlysis of gamma-ray emitting samples for environmental surveillance, 9:50543 (R;DD;In German)
Q Codes
User's guide for QPSOL (Version 3.2): a Fortran package for quadratic programming, 9:51062 (R;US)
R Codes
Physical models and numerical methods of the reactor dynamic computer program RETRAN, 9:49895 (R;AT;In German)
RACETRACK - a computer code for the simulation of nonlinear particle motion in accelerators, 9:50452 (R;DE)
S Codes
Benefit effort relation of sacrificial layers (SACRI), 9:49845 (R;DE;In German)
Performance analysis of VVER-type fuel rods with the STOFFEL-1 computer code, 9:49778 (R;DD)
SKINATH - a computer program for solving the reactor point kinetics equations with simple thermal-hydraulic feedback, 9:49801 (R;US)
SSYST-3. Input description, 9:49873 (R;DE;In German)
COMPUTER GRAPHICS
Design
Graphics capabilities, 9:50379 (RA;US)
Manuals
Introduction to LBL graphics, 9:51057 (R;US)
Systems Analysis
Graphics capabilities, 9:50379 (RA;US)
COMPUTER NETWORKS
Data Processing
Automatic system of scientific investigations for nuclear analysis, 9:51053 (RA;SU;In Russian)
Data Transmission
Automatic system of scientific investigations for nuclear analysis, 9:51053 (RA;SU;In Russian)
COMPUTER PROGRAMMING
See PROGRAMMING
COMPUTER PROGRAMS
See COMPUTER CODES
COMPUTER-AIDED DESIGN
Mathematical Models
Core numerical library, 9:50377 (RA;US)
Programming
Software tools, 9:50380 (RA;US)
Programming Languages
Appropriate implementation languages, 9:50378 (RA;US)
Systems Analysis
Applications of CASCADE, 9:50376 (RA;US)

COMPUTERIZED CONTROL SYSTEMS
Design
Issues in the design of a computer-aided systems and control analysis and design environment (CASCADE), 9:50374 (R;US)
Programming
Software tools, 9:50380 (RA;US)
Systems Analysis
Appropriate implementation languages, 9:50378 (RA;US)
Core numerical library, 9:50377 (RA;US)
Issues in the design of a computer-aided systems and control analysis and design environment (CASCADE), 9:50374 (R;US)
COMPUTERIZED SIMULATION
Differential Equations
Coefficients determination of differential state equations from Laplace transfer function, 9:51052 (R;TW;CH)
COMPUTERS
Design
Future hardware, 9:50381 (RA;US)
Standards
Future hardware, 9:50381 (RA;US)
CONCENTRATIONS (RADIONUCLIDES)
See RADIOACTIVITY
CONCENTRATOR SOLAR CELLS
Prior to July, 1979 SOLAR CELLS or specific solar cells descriptors and SOLAR CONCENTRATORS were used to index this concept.
Fresnel Lens
Development of a low-cost extrusion-embossing process for a linear Fresnel lens photovoltaic concentration, 9:49626 (R;US)
Meetings
Photovoltaic concentrator technology project, 9:49625 (R;US)
CONCRETES
Chemical Preparation
Method for incorporating radioactive phosphoric acid solutions in concrete, 9:50216 (P;US)
CONDENSED AROMATICS
See also ANTHRACENE
TRIPHENYLENE
Chemical Properties
Electrochemical properties of the solvent $SbCl_3$-$AlCl_3$-N-(1-BUTYL)pyridinium chloride and electrochemical and spectroelectrochemical studies of the solute 9,10-dimethylanthracene, 9:50325 (J;US)
Electrical Properties
Electrochemical properties of the solvent $SbCl_3$-$AlCl_3$-N-(1-BUTYL)pyridinium chloride and electrochemical and spectroelectrochemical studies of the solute 9,10-dimethylanthracene, 9:50325 (J;US)
Spectra
Electrochemical properties of the solvent $SbCl_3$-$AlCl_3$-N-(1-BUTYL)pyridinium chloride and electrochemical and spectroelectrochemical studies of the solute 9,10-dimethylanthracene, 9:50325 (J;US)
CONDUCTORS (ELECTRIC)
See ELECTRIC CONDUCTORS
CONING
See CHANNELING
CONSERVATION (ENERGY)
See ENERGY CONSERVATION
CONSOLIDATED FUEL REPROCESSING PROGRAM
Automatic camera tracking for remote manipulators, 9:49516 (R;US)
CONTACTORS
See SWITCHES
CONTACTS (ELECTRIC)
See ELECTRIC CONTACTS
CONTAINMENT BUILDINGS
Radioactivity Transport
DEMONA - research program for the demonstration of nuclear aerosol behaviour, 9:49872 (R;DE;In German)
CONTAMINATION (INTERNAL)
See RADIONUCLIDE KINETICS
CONTENT ANALYSIS
See CHEMICAL ANALYSIS
CONTINENTAL SHELF
Natural Gas Deposits
Analysis of changes introduced under the proposed OCS leasing schedule, 9:49456 (R;US)
Identification of changes introduced under the proposed OCS leasing schedule, 9:49467 (R;US)
Proposed changes to natural gas laws (Part 5). Hearings before the Subcommittee on Fossil and Synthetic Fuels of the Committee on Energy and Commerce, House of Representatives, Ninety-Eighth Congress, First Session, 9:49484 (B;US)
Summary of United States-Canada and United States-Mexico maritime boundary disputes in relationship to hydrocarbon resources, 9:49469 (R;US)
Petroleum Deposits
Analysis of changes introduced under the proposed OCS leasing schedule, 9:49456 (R;US)
Summary of United States-Canada and United States-Mexico maritime boundary disputes in relationship to hydrocarbon resources, 9:49469 (R;US)
CONTRACTS
Financing
Department-wide review of advance financing by letter of credit, 9:51046 (R;US)
CONTROL ELEMENTS
Positioning
Position measurement of reactor control rods in start-up experiments, 9:49824 (RA;CS;In Czech)
CONTROL EQUIPMENT
See also ELECTRIC CONTROLLERS
FLOW REGULATORS
Reliability
High reliability instrumentation systems (Subsea control system for monitoring well heads), 9:50436 (R;NO;In Norwegian)
CONTROL (RADIOACTIVITY)
See RADIATION MONITORING
CONTROL ROD DRIVES
Reactor Control Systems
Control and testing unit for linear stepping drive of WWER 1000 reactor regulating rod, 9:49819 (RA;CS;In Czech)
CONTROL RODS
See CONTROL ELEMENTS
CONTROL ROOMS
Regulations
Review of regulatory requirements governing control room habitability systems, 9:49827 (R;US)
CONTROL SYSTEMS
For automated processes including feedback.
See also COMPUTERIZED CONTROL SYSTEMS
REACTOR CONTROL SYSTEMS
Computer-Aided Design
Executive summary, 9:50375 (RA;US)
Mathematical Models
Core numerical library, 9:50377 (RA;US)
Microprocessors
Microprocessor-based monitoring and control project. Phase I report, 9:50504 (R;US)
Standards
Future hardware, 9:50381 (RA;US)
CONTROL THEORY (REACTOR)
See REACTOR KINETICS
COOK INLET
See GULF OF ALASKA
COOKING
See FOOD PROCESSING
COOLANT-FUEL INTERACTIONS
See FUEL-COOLANT INTERACTIONS
COOLERS
See HEAT EXCHANGERS
COOLING SYSTEMS
See also THERMONUCLEAR REACTOR COOLING SYSTEMS
Injection
Survey of research work on injection cooling at Delft Technical University, 9:49751 (TJ;GB)
Materials
Aluminum alloy performance in industrial air-cooled applications, 9:50156 (J;US)

Research Programs
Survey of research work on injection cooling at Delft Technical University, 9:49751 (TJ;GB)
COOLING TOWERS
Corrosion
Gasification wastewater treatment and reuse, 9:49331 (RA;US)
COPPER
Activation Analysis
Neutron activation analysis on a series of human gallstones, 9:50272 (RA;AU)
Annealing
Picosecond laser-induced surface transformations in solids, 9:50253 (BA;NL)
Physical Radiation Effects
Picosecond laser-induced surface transformations in solids, 9:50253 (BA;NL)
Soil Chemistry
Attenuation of chemical elements in acidic leachates from coal mineral wastes by soils, 9:49407 (R;US)
Sputtering
New method for determination of interstitial profiles and sputtering coefficients, 9:50738 (RA;SU;In Russian)
Surface Properties
Picosecond laser-induced surface transformations in solids, 9:50253 (BA;NL)
COPPER ALLOYS
Corrosion Protection
Method for preparing surfaces of metal composites having a brittle phase for plating, 9:50148 (P;US)
Critical Current
Effect of Ta additions upon in situ prepared Nb_3 Sn-Cu superconducting wire, 9:50386 (J;US)
Critical Field
Effect of Ta additions upon in situ prepared Nb_3 Sn-Cu superconducting wire, 9:50386 (J;US)
Etching
Method for preparing surfaces of metal composites having a brittle phase for plating, 9:50148 (P;US)
Grain Boundaries
Atomistic studies of grain boundaries with segregated impurities. Final progress report, July 1983-June 30, 1984, 9:50108 (R;US)
Neutron Diffraction
Neutron diffraction study of the tetragonal $NpCu_4Al_8$ and $ErFe_4Al_8$ intermetallic compounds, 9:50114 (RA;IL)
Shot Peening
Method for preparing surfaces of metal composites having a brittle phase for plating, 9:50148 (P;US)
Surface Treatments
Method for preparing surfaces of metal composites having a brittle phase for plating, 9:50148 (P;US)
COPPER COMPLEXES
Luminescence
Multiple luminescence from borohydridobis(triphenylphosphine) copper(I), 9:50305 (J;US)
COPPER COMPOUNDS
See also COPPER OXIDES
COPPER SELENIDES
Deposition
Submicron conductor array fabricated from a recrystallized eutectic thin film, 9:50155 (BA;NL)
Recrystallization
Submicron conductor array fabricated from a recrystallized eutectic thin film, 9:50155 (BA;NL)
COPPER OXIDES
Excitons
Subnanosecond time-resolved emission study of Cu_2O and GaAs, 9:50203 (R;US)
Optical Properties
Subnanosecond time-resolved emission study of Cu_2O and GaAs, 9:50203 (R;US)
Photoluminescence
Subnanosecond time-resolved emission study of Cu_2O and GaAs, 9:50203 (R;US)
Raman Effect
Time-resolved resonant Raman scattering and hot luminescence at the 1S ortho-exciton in Cu_2O, 9:50747 (R;US)
Sorptive Properties
Metal/metal oxides as high temperature desulfurization sorbents, 9:49338 (RA;US)
COPPER SELENIDES
Carrier Density
Electronic properties versus composition of thin films of $CuInSe_2$, 9:49629 (J;US)
Chemical Composition
Electronic properties versus composition of thin films of $CuInSe_2$, 9:49629 (J;US)
Electrical Properties
Electronic properties versus composition of thin films of $CuInSe_2$, 9:49629 (J;US)
Electrochemistry
n-$CuInSe_2$ based photoelectrochemical cells: Improved, stable performance in aqueous polyiodide through rational surface and solution modifications, 9:49628 (J;US)
Etching
n-$CuInSe_2$ based photoelectrochemical cells: Improved, stable performance in aqueous polyiodide through rational surface and solution modifications, 9:49628 (J;US)
Oxidation
n-$CuInSe_2$ based photoelectrochemical cells: Improved, stable performance in aqueous polyiodide through rational surface and solution modifications, 9:49628 (J;US)
Photochemistry
n-$CuInSe_2$ based photoelectrochemical cells: Improved, stable performance in aqueous polyiodide through rational surface and solution modifications, 9:49628 (J;US)
Stoichiometry
Electronic properties versus composition of thin films of $CuInSe_2$, 9:49629 (J;US)
COPPER VAPOR LASERS
See GAS LASERS
CORE CATCHERS
Benefit effort relation of sacrificial layers, 9:49845 (R;DE;In German)
CORES (DRILL)
See DRILL CORES
CORES (MAGNET)
See MAGNET CORES
CORES (REACTOR)
See REACTOR CORES
CORIUM
Cooling
Design features to enhance debris bed coolability, 9:49851 (R;US)
Dryout
Coolability of UO_2 debris beds in pressurized water pools: DCC-1 and DCC-2 experiment results. Revision, 9:49899 (R;US)
Reactor Safety Experiments
Investigation in the BETA-test facility into the interaction between a core melt and concrete, 9:49868 (RA;DE;In German)
CORN STOVER
See AGRICULTURAL WASTES
CORROSION
Measuring Methods
Evaluation of the three-point method to measure corrosion rates, 9:49730 (J;US)
CORROSION RESISTANT ALLOYS
See also ALLOY-IN-939
STAINLESS STEELS
Electrodeposition
Method for preparing surfaces of metal composites having a brittle phase for plating, 9:50148 (P;US)
COSMIC GAMMA BURSTS
Emission Spectra
Emission model of gamma-ray bursts, 9:50698 (R;US)
COSMIC GAMMA RAYS
See COSMIC PHOTONS

COSMIC NUCLEI
Prior to July , 1975 information was indexed to NUCLEI.
Chemical Composition
Elemental advances of ultraheavy cosmic rays, 9:50700 (R;US)
Energy Spectra
Heavy ions in space (M0001), 9:50677 (R;US)
Linear energy transfer spectrum measurement experiment (P0006), 9:50679 (R;US)
Measurement of heavy cosmic-ray nuclei on LDEF (M0002-2), 9:50678 (R;DE)
Spectra
High-resolution study of ultra-heavy cosmic-ray nuclei (A0178) (Z = 30 to 92), 9:50676 (R;IE)
COSMIC PARTICLES
See COSMIC RADIATION
COSMIC PHOTONS
Prior to July, 1975 information was indexed to PHOTONS.
Energy Spectra
High resolution hard X-ray spectra of solar and cosmic sources, 9:50684 (R;US)
COSMIC RADIATION
From sources other than the sun; not for SOLAR RADIATION.
See also COSMIC NUCLEI
COSMIC PHOTONS
PRIMARY COSMIC RADIATION
TOPEX orbital radiation study, 9:50695 (R;US)
Background Radiation
Microwave and theoretical studies for Cosmic Background Explorer satellite, 9:50702 (R;US)
Energy Spectra
Linear energy transfer spectrum measurement experiment (P0006), 9:50679 (R;US)
Neutrino Reactions
The contribution of cosmogenic radioisotopes to solar neutrino flux measurements, 9:50709 (J;US)
COSMIC RADIO SOURCES
See also SUPERNOVA REMNANTS
Extragalactic radio sources, 9:50690 (R;US)
COSMIC X RAYS
See COSMIC PHOTONS
COSMIC X-RAY SOURCES
Limits on soft X-ray flux from distant emission regions, 9:50691 (R;US)
Polarization
A search for X-ray polarization in cosmic X-ray sources, 9:50699 (R;US)
Variations
X-ray emission from Centaurus A, 9:50674 (R;US)
COSMOGONY
See COSMOLOGY
COSMOLOGICAL MODELS
The universe strikes back, 9:50711 (BA;US)
Grand Unified Theory
Models which allow a "new inflationary" universe history, 9:50708 (J;US)
Supersymmetry
Supersymmetric inflationary cosmology, 9:50669 (R;US)
COSMOLOGY
Reviews
Quark-hadron and chiral transitions and their relation to the early universe, 9:50710 (J;NL)
COSMOS
See UNIVERSE
COST
Allocations
Cost classification approaches in TVA cost-of-service methodology, 9:49958 (R;US)
Classification
Cost classification approaches in TVA cost-of-service methodology, 9:49958 (R;US)
Functional Analysis
Cost classification approaches in TVA cost-of-service methodology, 9:49958 (R;US)
COST BENEFIT ANALYSIS
Residential Sector
Cost classification approaches in TVA cost-of-service methodology, 9:49958 (R;US)
COULOMB EXCITATION
Corrections
Relativistic corrections to the theory of Coulomb excitation, 9:50908 (RA;AU)
COUMARIN
Photolysis
Kinetics of the photoprotolytic reaction in a solution of coumarin dye, 9:50344 (TJ;DE;In German)
COUNTERFLOW COOLING TOWERS
See COOLING TOWERS
COUNTING TECHNIQUES
See also LOW LEVEL COUNTING
SCINTILLATION COUNTING
Dosemeters
Sequential Analyse of the data of a monitor for radioactive radiation, 9:50477 (R;DE;In German)
Monte Carlo Method
Sequential Analyse of the data of a monitor for radioactive radiation, 9:50477 (R;DE;In German)
COUNTY BUILDINGS
See PUBLIC BUILDINGS
COUPLINGS
Design
Variable output coupler for laser cavities with totally reflecting mirrors, 9:50396 (P;US)
COURT BUILDINGS
See PUBLIC BUILDINGS
CRAB NEBULA
Emission Spectra
Cosmic rays and the emission line regions of active galactic nuclei, 9:50694 (R;US)
Hard X Radiation
High resolution hard X-ray spectra of solar and cosmic sources, 9:50684 (R;US)
CRABS
Molting
Muscle atrophy and restoration during molting, 9:50600 (R;US)
CRITICALITY ACCIDENTS
See RADIATION ACCIDENTS
CROSSFLOW COOLING TOWERS
See COOLING TOWERS
CROSSING SYMMETRY
P_{11} channel and the effects of crossing symmetry, 9:50797 (RA;AU)
CRUDE OIL
See PETROLEUM
CRYSTAL PHASE TRANSITIONS
See CRYSTAL-PHASE TRANSFORMATIONS
CRYSTAL-PHASE TRANSFORMATIONS
Propagation of sound at continuous structural phase transitions, 9:50941 (R;US)
CRYSTALS
See also LIQUID CRYSTALS
MONOCRYSTALS
Crystal-Phase Transformations
Propagation of sound at continuous structural phase transitions, 9:50941 (R;US)
Elasticity
Elastic constants of plastic crystals by Schaefer-Bergmann scattering, 9:50207 (J;US)
Ion Channeling
Applications of channeling in ion beam analysis of crystals, 9:50190 (RA;AU)
Light Scattering
Elastic constants of plastic crystals by Schaefer-Bergmann scattering, 9:50207 (J;US)
Orientation
Elastic constants of plastic crystals by Schaefer-Bergmann scattering, 9:50207 (J;US)
Sound Waves
Propagation of sound at continuous structural phase transitions, 9:50941 (R;US)
Ultrasonic Waves
Elastic constants of plastic crystals by Schaefer-Bergmann scattering, 9:50207 (J;US)
CULTURAL OBJECTS
Objects of historical and/or artistic value.

Isotope Dating
Energy dispersive X-ray elemental analysis for pigments identification of tempera painting, 9:50270 (RA;BG;In Bulgarian)
CULTURES (TISSUE)
See TISSUE CULTURES
CURIUM
Environment
Radioecological research on the behavior of actinides in the environment, 9:49870 (RA;DE;In German)
CURRENT-DRIVE HEATING
Interpretation of LH current drive experiments, 9:50988 (RA;GB)
Lower hybrid current drive experiments on the Alcator C and the Versator II tokamaks, 9:50997 (RA;GB)
rf current drive in the presence of a dc electric field, 9:50993 (RA;GB)
Study of the current drive by the lower hybrid wave in a tokamak, 9:50996 (RA;GB)
Two-dimensional and relativistic effects in lower-hybrid current drive, 9:50987 (RA;GB)
Computerized Simulation
Computational model for lower hybrid current drive, 9:50991 (RA;GB)
Numerical simulation of current drive by lower hybrid waves, 9:50990 (RA;GB)
Velocity redistribution in lower hybrid current drive, 9:50992 (RA;GB)
Meetings
Non-inductive current drive in tokamaks, 9:51000 (R;GB)
Neutral Atom Beam Injection
Review of current drive by fast ion injection, 9:50982 (RA;GB)
Nonlinear Problems
Nonlinear theory of lower hybrid current drive - a two-dimensional Fokker-Planck study, 9:50986 (RA;GB)
Runaway Electrons
Runaways and current drive, 9:50989 (RA;GB)
Stochastic Processes
Stochastic generation of currents by lower-hybrid waves, 9:50994 (RA;GB)
CURRENTS (WATER)
See WATER CURRENTS
CUTTING TOOLS
Materials
Relations between material properties and performance of wear resistant materials, 9:50161 (R;DE;In German)
CYANOACETYLENE
See PROPIOLONITRILE
CYCLOHEXANE
Chemical Reactions
Reactions of $FeCH_3i$ and $CoCH_3^+$ with cyclic hydrocarbons in the gas phase, 9:50323 (J;US)
CYCLONE SEPARATORS
Performance Testing
Electrocyclone development program, 9:50437 (RA;US)
CYLINDRICAL PARABOLIC COLLECTORS
See PARABOLIC TROUGH COLLECTORS
CZECHOSLOVAKIA
Energy Policy
CSSR - energy situation 1980/81, 9:49950 (R;DE;In German)
Energy Supplies
CSSR - energy situation 1980/81, 9:49950 (R;DE;In German)

D

D RESONANCES
Semileptonic Decay
Mass and form factor effects in spectrum and width of the semileptonic decays of charmed mesons, 9:50779 (RA;BG;In Bulgarian)
DAMS
Failures
Low head, micro-hydro demonstration project, Coker, Alabama. Final report, 9:49595 (R;US)
DATA ACQUISITION SYSTEMS
Measuring Instruments
Survey of remote data monitoring systems, 9:49692 (R;US)
DATA ANALYSIS
Computer Graphics
Organizational tools for data analysis environments, 9:51060 (R;US)
Programming
Role of environments in managing data analysis, 9:51059 (R;US)
DATA PROCESSING
Manipulation of unit facts.
Compression
Recent advances in data compression, 9:51050 (R;US)
Fourier Analysis
Data processing with small statistics by Fourier analysis, 9:51054 (RA;SU;In Russian)
Magnetic Tapes
Beginner's guide to blocked records on magnetic tape, 9:51058 (R;US)
Memory Devices
Analytical model for an input/output-subsystem, 9:51055 (R;DE;In German)
DATA STORAGE DEVICES
See MEMORY DEVICES
DAUGHTER PRODUCTS
Body Burden
Activity ratios of thorium daughters in vivo, 9:50556 (R;US)
Dosimetry
Activity ratios of thorium daughters in vivo, 9:50556 (R;US)
DAYLIGHTING
Correlations of solar irradiance and daylight illuminance for building energy analysis, 9:50006 (R;US)
DC SYSTEMS
Electrical Insulators
Particle charging in a turbulent air stream, 9:49758 (R;US)
Power Transmission Lines
Particle charging in a turbulent air stream, 9:49758 (R;US)
DEASHING
Bench-Scale Experiments
Coal liquefaction and deashing studies--2. Solvent refined coal process, 9:49375 (J;US)
DEBRIS (NUCLEAR)
See FISSION PRODUCTS
DECAY
For nuclear or particle decay only.
See also BETA DECAY
PARTICLE DECAY
Reviews
Properties of heavy-ion produced nuclei far from stability, 9:50870 (R;DE)
DECAY PRODUCTS
See DAUGHTER PRODUCTS
DECHANNELING
See CHANNELING
DECIDUOUS TREES
See TREES
DECONTAMINATION
Extraction Chromatography
Decontamination of carbonate containing process streams in a reprocessing plant by chromatography, 9:49519 (R;DE;In German)
DECONTAMINATION FACTOR
See DECONTAMINATION
DEEP INELASTIC HEAVY ION REACTIONS
Color Model
Signatures of new phenomena in ultrarelativistic nuclear collisions, 9:50921 (J;NL)
Dissipation Factor
New statistical and nonstatistical effects in deep inelastic heavy-ion collision, 9:50919 (J;IT)
Gluon Model
Signatures of new phenomena in ultrarelativistic nuclear collisions, 9:50921 (J;NL)

Mass Spectra
New statistical and nonstatistical effects in deep inelastic heavy-ion collision, 9:50919 (J;IT)
Statistical Models
New statistical and nonstatistical effects in deep inelastic heavy-ion collision, 9:50919 (J;IT)

DEGRADATION (ENERGY)
See ENERGY LOSSES

DEGRADATION (NUCLEAR)
See DECAY

DEHYDROGENATION
Molecular Models
Kinetics - studies I. Model experiments with dehydrogenation of propane and isomerization of pentane, 9:50319 (R;NO;In Norwegian)

DELTA RESONANCES (MESON)
See MESON RESONANCES

DENSITY (ENERGY-LEVEL)
See ENERGY-LEVEL DENSITY

DEOXYPENTOSE NUCLEIC ACID
See DNA

DEOXYRIBONUCLEIC ACID
See DNA

DEPARTMENT OF INTERIOR
See US DOI

DESERTRON
See SUPERCONDUCTING SUPER COLLIDER

DESICCANTS
Heat Transfer
Modeling of solid-side mass transfer in desiccant particle beds, 9:49700 (BA;US)
Mass Transfer
Modeling of solid-side mass transfer in desiccant particle beds, 9:49700 (BA;US)
Molding
Method and composition for molding low density desiccant syntactic foam articles, 9:50180 (P;US)

DESIGN
Reviews
SRC-1: coal liquefaction demonstration plant. Project Baseline assessment report supplement, 9:49347 (R;US)

DESOXYRIBONUCLEIC ACID
See DNA

DEUTERIUM
Diffusion
Diffusion of deuterium and hydrogen in rutile TiO_2 crystals at low temperatures, 9:50208 (J;US)
Fusion Reactions
Experimental study of muon-catalyzed fusion in low-density deuterium-tritium gas, 9:50752 (J;US)
Muonic Atoms
Experimental study of muon-catalyzed fusion in low-density deuterium-tritium gas, 9:50752 (J;US)
Polarized Targets
Design of a tensor polarized deuterium target polarized by spin-exchange with optically pumped NA, 9:50459 (R;US)
Targets
Tritium/deuterium gas cell, 9:50465 (R;US)

DEUTERIUM OXIDES
See HEAVY WATER

DEUTERIUM TARGET
Neutron Reactions
Comparison of neutron-deuteron and proton-deuteron analysing powers, 9:50831 (RA;AU)
Photonuclear Reactions
Measurement of coherent π^0 photoproduction on ^{3}He and ^{3}H in the resonance region, 9:50828 (R;DE)
Theoretical calculation of the forward cross section for deuteron photodisintegration at low energies, 9:50829 (RA;AU)
Pion Plus Reactions
Tensor polarisation t_{20} in pion-deuteron elastic scattering, 9:50832 (RA;AU)
Proton Reactions
Comparison of neutron-deuteron and proton-deuteron analysing powers, 9:50831 (RA;AU)

DEUTERON REACTIONS
Pickup Reactions
^{46}Ca(d,^{3}He)^{47}K reaction at 80 MeV, 9:50863 (RA;AU)

DEUTERON-DEUTERON INTERACTIONS
See DEUTERIUM TARGET
DEUTERON REACTIONS

DEVICES
See EQUIPMENT

DEVONIAN SHALES
See BLACK SHALES

DIAL PAINTERS
Delayed Radiation Effects
Current (1984) status of the study of ^{226}Ra and ^{228}Ra in humans at the Center for Human Radiobiology, 9:50608 (R;US)

DIAMOND DRILLING EQUIPMENT
See DRILLING EQUIPMENT

DIAMONDS
Electron Channeling
Emission spectrum at electron plane channeling with account for dechanneling and collimation, 9:50197 (RA;SU;In Russian)
Emission Spectra
Emission spectrum at electron plane channeling with account for dechanneling and collimation, 9:50197 (RA;SU;In Russian)

DIAPHRAGMS (THERMONUCLEAR DEVICE)
See LIMITERS

DIBORANE
See BORANES

DIDO-JUELICH REACTOR
See FRJ-2 REACTOR

DIELECTRIC TRACK DETECTORS
Characteristics of a radon diffusion chamber with electrical collection using plastic nuclear track detectors. Open file report 31 August 1982-30 November 1983, 9:50485 (R;US)

DIENES
See also BUTADIENE
Isomerization
Singlet sensitization of the norbornadiene rearrangement: excitation energy cascade potentially involving triplet exciplexes, 9:50345 (J;GB)

DIES
Design
Optimization of the die entrance shape for polymeric extrusion, 9:50178 (R;US)

DIESEL ENGINES
Air Pollution
Influence of particles in diesel engine exhaust gas during cooling and mixing with the surrounding air, 9:50080 (R;DE;In German)
Air Pollution Abatement
Reduction of emission of particles, carcinogenic polycyclic hydrocarbons and nitric oxides of a direct injection diesel engine by the diesel-gas process, 9:50081 (R;DE;In German)
Combustion
Dissertation on a direct injection Diesel process with automatic control, dependent on load, of the ratio of the fuel adhering to the walls to that distributed in the air, with particular attention to exhaust gas turbo-supercharging and exhaust gas feedback, 9:50082 (R;DE;In German)
Economic Analysis
Diesel engine for with and without supercharging, 9:50071 (RA;DD;In German)
Exhaust Gases
Reduction of emission of particles, carcinogenic polycyclic hydrocarbons and nitric oxides of a direct injection diesel engine by the diesel-gas process, 9:50081 (R;DE;In German)
Fuel Consumption
Diesel engine for passenger cars with and without supercharging, 9:50070 (RA;DD;In German)
Diesel engine for with and without supercharging, 9:50071 (RA;DD;In German)

Fuel Economy
Military adaptation of commercial items (MACI) laboratory evaluation of the Code E-430 engine. Final report, 9:50067 (R;US)
Military adaptation of commercial items: laboratory evaluation of the Code E-436 engine. Technical report 17 January-28 July 1983, 9:50068 (R;US)
Operation
Diesel engine for with and without supercharging, 9:50071 (RA;DD;In German)
Performance
Diesel engine for passenger cars with and without supercharging, 9:50070 (RA;DD;In German)
Diesel engine for with and without supercharging, 9:50071 (RA;DD;In German)
Dissertation on a direct injection Diesel process with automatic control, dependent on load, of the ratio of the fuel adhering to the walls to that distributed in the air, with particular attention to exhaust gas turbo-supercharging and exhaust gas feedback, 9:50082 (R;DE;In German)
Performance Testing
Military adaptation of commercial items (MACI) laboratory evaluation of the Code E-430 engine. Final report, 9:50067 (R;US)
Military adaptation of commercial items: laboratory evaluation of the Code E-436 engine. Technical report 17 January-28 July 1983, 9:50068 (R;US)

DIESEL FUELS
Chemical Composition
Diesel fuel oils, 1983, 9:49472 (R;US)
Chemical Properties
Diesel fuel oils, 1983, 9:49472 (R;US)
Physical Properties
Diesel fuel oils, 1983, 9:49472 (R;US)
Prices
State Energy Price System: 1982 update, 9:49952 (R;US)
Sales
Petroleum marketing monthly, July 1984, 9:49455 (R;US)

DIESEL OIL (FRACTION)
See DIESEL FUELS

DIGESTER GAS
See METHANE

DIGITIZERS
Maintenance
Description and repair procedure for optical digitizers PAC-4, 9:50500 (R;PK)
Repair
Description and repair procedure for optical digitizers PAC-4, 9:50500 (R;PK)

2,2-DIMETHYLPROPANE
See 2-2-DIMETHYLPROPANE

2-2-DIMETHYLPROPANE
Chemical Reactions
Reactions of $FeCH_3i$ and $CoCH_3^+$ with aliphatic alkanes in the gas phase, 9:50322 (J;US)

DINITROSORESORCINOL
See CHLORINS

DIOLS
See GLYCOLS

DIRAC EQUATION
Differential Geometry
Kaehler's geometric description of Dirac fields, 9:50800 (R;DE)
Solitons
Solitons in solid state physics, 9:50973 (R;AT)

DIRAC MATRICES
See DIRAC OPERATORS

DIRAC MONOPOLES
See MAGNETIC MONOPOLES

DIRAC OPERATORS
Asymmetry
Spectral asymmetry on an open space, 9:50810 (J;US)

DIRECT CONTACT HEAT EXCHANGERS
Design
Direct-contact closed-loop heat exchanger, 9:50406 (P;US)

DIRECT GAIN SYSTEMS
Prior to September 1980 HEAT GAIN was used to index this concept.
Performance
Living Systems. Monthly performance report, 9:49695 (R;US)

DIRECTIONAL DRILLING
Feasibility Studies
Feasibility study: vertical fracturing in directionally drilled wells. Final report, January 1983-September 1983, 9:49482 (R;US)

DISINTEGRATION (NUCLEAR)
See DECAY

DISLOCATIONS
Numerical Solution
Dislocation theory, 9:50181 (BA;FR)

DISPERSE SYSTEMS
See DISPERSIONS

DISPERSIONS
For the state of aggregation in materials; if related to wave phenomena see DISPERSION RELATIONS or OPTICAL DISPERSION.
See also COLLOIDS
MIXTURES
Environmental Transport
Development of numerical simulation models for vertical solute transport in unsaturated soils and unconsolidated sediments, 9:50554 (R;DE;In German)
Particle Size
Development of particle-sizing for high concentrated colloidal dispersions based on photon correlations spectroscopy, 9:50296 (R;DE;In German)

DISSOLVED OXYGEN
See OXYGEN

DISTRICT HEATING
See also SOLAR DISTRICT HEATING
Energy Consumption
Economic evaluation of a district heating plant in Trysil (Norway), 9:49925 (R;NO;In Norwegian)
Investment
Economic evaluation of a district heating plant in Trysil (Norway), 9:49925 (R;NO;In Norwegian)
Profits
Economic evaluation of a district heating plant in Trysil (Norway), 9:49925 (R;NO;In Norwegian)
Water Source Heat Pumps
Lake water heat for a heating central at Kvarnberget, Falun, Sweden. Preliminary study, 9:50064 (R;SE;In Swedish)
Waste heat recovery from waste water with a heat pump for 400 flats in Falun. Project plan, 9:50063 (R;SE;In Swedish)
Wood Fuels
Economic evaluation of a district heating plant in Trysil (Norway), 9:49925 (R;NO;In Norwegian)

DITE TOKAMAK
Current-Drive Heating
Dilution effect in beam-driven current experiments, 9:51015 (RA;GB)
Neutral Atom Beam Injection
Dilution effect in beam-driven current experiments, 9:51015 (RA;GB)

DIVERTORS
Interactions
Plasma surface interaction processes and possible synergisms, 9:51026 (R;US)

DNA
Biological Repair
Effect of 3-aminobenzamide on the rate of ligation during repair of alkylated DNA in human fibroblasts, 9:50646 (J;US)
Strand Breaks
Effect of 3-aminobenzamide on the rate of ligation during repair of alkylated DNA in human fibroblasts, 9:50646 (J;US)

DNA ADDUCTS
Molecular Structure
Conformations of DNA adducts with polycyclic aromatic carcinogens, 9:50587 (R;US)

DODECANE
Crystal Structure
Synchrotron x-ray study of the orientational ordering D2-D1 structural phase transition of freely suspended discotic strands in triphenylene hexa-n-dodecanoate, 9:50320 (J;US)
Crystal-Phase Transformations
Synchrotron x-ray study of the orientational ordering D2-D1 structural phase transition of freely suspended discotic strands in triphenylene hexa-n-dodecanoate, 9:50320 (J;US)
DORMITORIES
See RESIDENTIAL BUILDINGS
DOSE LIMITS
Recommendations
Dose limits for radiological workers, 9:50936 (RA;NL;In Dutch)
DOSEMETERS
Counting Techniques
Sequential Analyse of the data of a monitor for radioactive radiation, 9:50477 (R;DE;In German)
Design
Integrating dosimeter for pulsed radiation, 9:50476 (R;US)
DOSIMETERS
See DOSEMETERS
DOW PUSHER 700
See POLYAMIDES
DOWTHERM
See PHENYL ETHER
DREDGING
Waste Disposal
Thalweg disposal: demonstration of an alternative, 9:50567 (R;US)
DRILL CORES
Radioactivity
Feasibility of the use of nuclear-emulsion techniques in the study of drill core and water samples from the Monticello mill, Monticello, Utah, 9:49568 (R;US)
DRILL SHIPS
See OFFSHORE PLATFORMS
DRILLING EQUIPMENT
Design
Apparatus for recovering gaseous hydrocarbons from hydrocarbon-containing solid hydrates, 9:49483 (P;US)
DRILLING PLATFORMS
See OFFSHORE PLATFORMS
DROPLETS
Evaporation
Experiment for triggered fragmentation with a molten copper-drop in water, 9:50401 (R;DE;In German)
DRY SCRUBBERS
Performance Testing
APT dry plate scrubber for particulate collection at high temperature and pressure, 9:49392 (RA;US)
Laboratory/bench scale testing and evaluation of A.P.T. dry plate scrubber. Fifty third monthly report, July 1-31, 1984, 9:49385 (R;US)
DRYING
See also SOLAR DRYING
Biological Effects
Interpreting the metabolic responses of plants to water stress, 9:50588 (J;US)
DRY-TYPE COOLING TOWERS
See COOLING TOWERS
DTO
See HEAVY WATER
TRITIUM COMPOUNDS
DUOPLASMATRONS
Reviews
State and development of ion sources for accelerators, 9:50466 (R;DD;In German)
Technology Assessment
State and development of ion sources for accelerators, 9:50466 (R;DD;In German)
DUST COLLECTORS
Performance Testing
Design and development of a high temperature particle separator for particle control in coal gasification plants, 9:49344 (RA;US)
DYES
See also FLUORESCEIN
MORIN
RHODAMINES
Fluorescence
Concerning the question of the fluorescence yield of solutions (Rhodulin orange), 9:50328 (TJ;US)
DYMAC SYSTEM
See PLUTONIUM
DYNAMIC MATERIALS ACCOUNTABILITY SYSTEM
See PLUTONIUM
DYSPROSIUM 158
Heavy Ion Reactions
Heavy ion induced fission reactions, 9:50891 (RA;AU)
Neutron evaporation following heavy ion reactions for systems with $150 < A < 190$, 9:50883 (RA;AU)

E

EARTH ATMOSPHERE
See also MAGNETOSPHERE
Dispersion Relations
Method to estimate the vertical dispersion parameter in a 10 Km range, 9:50514 (R;US)
Hydroxyl Radicals
Shot noise limited detection of OH using the technique of laser induced fluorescence, 9:50513 (R;US)
Remote Sensing
Signal averaging limitations in heterodyne- and direct-detection laser remote sensing measurements, 9:50518 (BA;NL)
EBIS
See ELECTRON BEAM ION SOURCES
ECN
Energieonderzoek Centrum Nederland; prior to 1 August 1976 known as Reactor Centrum Nederland, and documents written before that date should be indexed to RCN.
Industrial Medicine
Industrial doctor and radiation hygiene at ECN, 9:50937 (RA;NL;In Dutch)
EDDY CURRENT TESTING
Experimental verification of eddy-current flaw theory, 9:50408 (R;US)
EFFLUENTS (CHEMICAL)
See CHEMICAL EFFLUENTS
EFFLUENTS (RADIOACTIVE)
See RADIOACTIVE EFFLUENTS
EHF RADIATION
See MICROWAVE RADIATION
EINSTEIN FIELD EQUATIONS
Analytical Solution
Class of solutions of the Einstein's equations. Solutions of the equations of the geodesics, 9:50961 (RA;BG;In Bulgarian)
Axial Symmetry
Solutions of the cosmological equations with cylindrical symmetry in space parts of the metrical interval, 9:50960 (RA;BG;In Bulgarian)
Geodesics
Class of solutions of the Einstein's equations. Solutions of the equations of the geodesics, 9:50961 (RA;BG;In Bulgarian)
Lagrangian Function
Equations with non zero energy momentum tensor for the gravitational field, 9:50958 (RA;BG;In Bulgarian)
Metrics
Class of solutions of the Einstein's equations. Solutions of the equations of the geodesics, 9:50961 (RA;BG;In Bulgarian)
Solutions of the cosmological equations with cylindrical symmetry in space parts of the metrical interval, 9:50960 (RA;BG;In Bulgarian)
EINSTEIN-DE SITTER MODEL
See COSMOLOGICAL MODELS

EINSTEINIUM 251
Fission
Neutron emission from accelerating fission fragments, 9:50876 (RA;AU)
EINSTEIN-MAXWELL EQUATIONS
Eigenvectors
Electrovac solutions with common shearing geodesic eigenrays, 9:50964 (R;HU)
EKA-HAFNIUM
See ELEMENT 104
EKA-OSMIUM
See ELEMENT 108
EKA-PLATINUM
See ELEMENT 110
EKA-TUNGSTEN
See ELEMENT 106
ELECTRIC ARCS
Optimization
Investigations of the double plasma arc in a graphite tube, 9:50289 (R;DE;In German)
ELECTRIC BATTERIES
Devices for production and/or storage of electrical energy from chemical reactions; excludes FUEL CELLS and RADIOISOTOPE BATTERIES.
See also LEAD-ACID BATTERIES
Electrodes
Defects and disorder in the fast-ion electrode lithium-aluminum, 9:49915 (J;US)
Research Programs
Assessment of research needs for advanced battery systems, 9:49913 (R;US)
ELECTRIC CONDUCTORS
Electrical Insulators
High voltage variable diameter insulator, 9:50209 (P;US)
Fabrication
Submicron conductor array fabricated from a recrystallized eutectic thin film, 9:50155 (BA;NL)
ELECTRIC CONTACTORS
See SWITCHES
ELECTRIC CONTACTS
Superconductors
Assembly and installation of a pair of superconducting buses for the Large Coil Test Facility, 9:51019 (R;US)
ELECTRIC CONTROLLERS
Design
Three phase AC motor controller, 9:50426 (P;US)
ELECTRIC FIELDS
Biological Effects
Effects of electromagnetic fields produced by high voltage transmission lines. Final report, 9:50652 (R;US)
ELECTRIC GENERATORS
Rotating generators only; excludes DIRECT ENERGY CONVERTERS.
See also TURBOGENERATORS
Monitoring
Generator monitoring and surveillance: workshop proceedings, 9:49747 (R;US)
Surveillance
Generator monitoring and surveillance: workshop proceedings, 9:49747 (R;US)
ELECTRIC MOTORS
Computerized Control Systems
Three phase AC motor controller, 9:50426 (P;US)
Electric Controllers
Three phase AC motor controller, 9:50426 (P;US)
ELECTRIC POWER
See also HYDROELECTRIC POWER
Comparative Evaluations
Electricity production cost in coal and nuclear power plants, 9:49794 (R;DE;In German)
Cost
Electricity production cost in coal and nuclear power plants, 9:49794 (R;DE;In German)
Cost Benefit Analysis
Cost classification approaches in TVA cost-of-service methodology, 9:49958 (R;US)
Marketing
Energy conservation and utility marketing strategies: is there a conflict?, 9:50045 (RA;US)
Prices
State Energy Price System: 1982 update, 9:49952 (R;US)
Residential Sector
Cost classification approaches in TVA cost-of-service methodology, 9:49958 (R;US)
ELECTRIC POWER INDUSTRY
Computer-Aided Design
Graphics capabilities, 9:50379 (RA;US)
Computerized Control Systems
Applications of CASCADE, 9:50376 (RA;US)
Appropriate implementation languages, 9:50378 (RA;US)
Executive summary, 9:50375 (RA;US)
Issues in the design of a computer-aided systems and control analysis and design environment (CASCADE), 9:50374 (R;US)
Computers
Future hardware, 9:50381 (RA;US)
Control Systems
Executive summary, 9:50375 (RA;US)
Future hardware, 9:50381 (RA;US)
ELECTRIC POWER RESEARCH INSTITUTE
See EPRI
ELECTRIC POWER SYSTEMS
See POWER SYSTEMS
ELECTRIC SWITCHES
See SWITCHES
ELECTRIC UTILITIES
Decision Making
Measuring effects of utility conservation programs: inputs to utility decision making, 9:50041 (RA;US)
Economic Analysis
Adapting state and national electricity consumption forecasting methods to utility service areas. Final report, 9:49956 (R;US)
Analysis of the financial health of the electric utility industry, 9:49957 (R;US)
Energy Conservation
Can a simple physically-based model provide accurate scorekeeping of electricity savings in houses?, 9:49991 (RA;US)
Conservation's value varies with view, 9:50024 (J;US)
Conservation as a utility planning option, 9:50037 (RA;US)
Conservation: a regulator's view, 9:50040 (RA;US)
Conservation in a load/resource planning and analysis process, 9:50046 (RA;US)
Conservation as part of a utility market plan: lessons learned, 9:50048 (RA;US)
Determinants of interest in new energy reduction projects among commercial and industrial ratepayers, 9:49993 (RA;US)
Electric utility sponsored conservation programs: case studies of implementation experience, 9:50042 (RA;US)
Energy conservation and utility marketing strategies: is there a conflict?, 9:50045 (RA;US)
EnergyCHECK commercial/industrial energy audit program, 9:50049 (RA;US)
Evolution of demand-side planning at PG and E, 9:50038 (RA;US)
Great PG and E energy rebate, 9:50051 (RA;US)
Home energy rating system, 9:49987 (RA;US)
Hood River Conservation Project, 9:49989 (RA;US)
Impact and cost-effectiveness of utility conservation programs: the Hartford Foundation project, 9:49992 (RA;US)
Measuring effects of utility conservation programs: inputs to utility decision making, 9:50041 (RA;US)
Northern States Power Company Appliance Rebate Program, 9:50050 (RA;US)
Operation wrap-up/seal-up; an inside look, 9:49990 (RA;US)
Residential load forecasting: intergrating end-use and econometric methods, 9:49983 (RA;US)
Responding to the conservation needs of low-income and multi-family residential customers, 9:49988 (RA;US)
Segmenting markets for conservation, 9:50047 (RA;US)
Structuring energy conservation for results, 9:50044 (RA;US)

Texas utilities' rebate program, 9:50043 (RA;US)
Utility financing of energy management: the Puget Sound Power and Light experience, 9:49986 (RA;US)
Vepco's Alternative Energy Study: incorporating and assessing energy conservation as a part of utility planning and goal formulation, 9:50039 (RA;US)
Financial Data
Analysis of the financial health of the electric utility industry, 9:49957 (R;US)
Fuel Substitution
Information on coal conversion activities at selected powerplants, 9:49953 (R;US)
Load Analysis
Adapting state and national electricity consumption forecasting methods to utility service areas. Final report, 9:49956 (R;US)
Load Management
Conservation as a utility planning option, 9:50037 (RA;US)
Evolution of demand-side planning at PG and E, 9:50038 (RA;US)
Measuring the impact of residential conservation programs: a case study, 9:49984 (RA;US)
Planning
Conservation in a load/resource planning and analysis process, 9:50046 (RA;US)
Vepco's Alternative Energy Study: incorporating and assessing energy conservation as a part of utility planning and goal formulation, 9:50039 (RA;US)
Surveys
Electric utility solar energy activities: 1983 survey, 9:49604 (R;US)
ELECTRICAL EQUIPMENT
See also ELECTRIC CONTACTS
ELECTRICAL INSULATORS
SHUNT REACTORS
SWITCHES
Energy Efficiency
Great PG and E energy rebate, 9:50051 (RA;US)
Marketing
Great PG and E energy rebate, 9:50051 (RA;US)
Safety Engineering
Electric arcing at high voltage during methane-air explosions inside explosion-proof enclosures. Technical progress report, 9:50364 (R;US)
ELECTRICAL INSULATORS
Design
High voltage variable diameter insulator, 9:50209 (P;US)
Electrical Testing
Determination of threshold and maximum operating electric stresses for selected high voltage insulations. Task III. Investigation of high voltage capacitor insulation. Progress report No. 4, 9:49759 (R;US)
Flashover
Particle charging in a turbulent air stream, 9:49758 (R;US)
Stresses
Determination of threshold and maximum operating electric stresses for selected high voltage insulations. Task III. Investigation of high voltage capacitor insulation. Progress report No. 4, 9:49759 (R;US)
ELECTRIC-POWERED VEHICLES
Energy Consumption
Energy characteristics of road vehicles represented by the example of an electric transporter, 9:50085 (R;DE;In German)
Road Tests
Energy characteristics of road vehicles represented by the example of an electric transporter, 9:50085 (R;DE;In German)
ELECTRODES
Materials
Defects and disorder in the fast-ion electrode lithium-aluminum, 9:49915 (J;US)
Modifications
Chemically-modified electrodes in photoelectrochemical cells (Tin oxide and TiO_2 semiconductor electrodes), 9:50330 (J;CA)
ELECTROLYTES
See also SOLID ELECTROLYTES
Acoustic Monitoring
Sonic resonator control and method for determining component concentration in multiple component molten liquids, 9:50146 (P;US)
Chemical Composition
Sonic resonator control and method for determining component concentration in multiple component molten liquids, 9:50146 (P;US)
ELECTROLYTIC CELLS
Materials Testing
Study of polymers and/or copolymers for use in the preparation of separators for the electrolysis of water: technology of the preparation of the separators. Final report, 9:49575 (R;LU;In Italian)
ELECTROMAGNETIC FIELDS
Spherical Configuration
Particles in spherical electromagnetic radiation fields, 9:50970 (R;AT)
ELECTRON ACCEPTOR
See ELECTRONS
ELECTRON BEAM ION SOURCES
Reviews
State and development of ion sources for accelerators, 9:50466 (R;DD;In German)
Technology Assessment
State and development of ion sources for accelerators, 9:50466 (R;DD;In German)
ELECTRON BEAMS
Beam Transport
The generation and use of semi-empirical electron transport models, 9:50455 (J;US)
ELECTRON CHANNELING
Acoustic ESR
Theory of orientational acoustic effect at channeling, 9:50951 (RA;SU;In Russian)
Bremsstrahlung
Radiation at planar channeling of relativistic electrons in thick crystals, 9:50954 (RA;SU;In Russian)
Elastic Scattering
Rainbow scattering and relativistic electron radiation in crystals at motion along axis, 9:50953 (RA;SU;In Russian)
ELECTRON COLLISIONS
Inelastic Scattering
Comments on the image contrast from inelastically scattered electrons, 9:50724 (R;US)
ELECTRON CYCLOTRON MASERS
See MICROWAVE AMPLIFIERS
ELECTRON DONOR
See ELECTRONS
ELECTRON GAS
Current-Drive Heating
rf current drive in the presence of a dc electric field, 9:50993 (RA;GB)
ELECTRON MICROSCOPY
See also TRANSMISSION ELECTRON MICROSCOPY
Images
Comments on the image contrast from inelastically scattered electrons, 9:50724 (R;US)
Meetings
Proceedings of the 17. scientific meeting, the Weizmann Institute of Science, April 7, 1983, 9:50091 (R;IL)
Replica Techniques
Application of extraction replicas and analytical electron microscopy to precipitate phase studies, 9:50100 (R;US)
ELECTRON REACTIONS
Inelastic Scattering
Analyses of electron and proton scattering to low excitation isoscalar states in ^{20}Ne, ^{24}Mg and ^{28}Si, 9:50856 (R;AU)
ELECTRONIC DATA PROCESSING
See DATA PROCESSING
ELECTRONIC EQUIPMENT
See also AMPLIFIERS
RADIO EQUIPMENT
Frequency Analysis
Spectral analyzer of vibroacoustic signals, 9:49818 (RA;CS;In Czech)

Reliability
High reliability instrumentation systems (Subsea control system for monitoring well heads), 9:50436 (R;NO;In Norwegian)
Stress Analysis
NASA flight electronics environmental stress screening survey, 9:50423 (R;US)
ELECTRON-POSITRON INTERACTIONS
Annihilation
Detectors for quark and gluon jets at high energies, 9:50762 (R;DE)
Evidence for local compensation of baryon number in e^+e^- annihilation, 9:50764 (R;DE)
Experimental test of the flavor independence of the quark-gluon coupling constant, 9:50765 (R;DE)
Measurement of R and search for the top quark in e^+e^- annihilation between 39.8 and 45.2 GeV, 9:50763 (R;DE)
Model dependence of the determination of the strong coupling constant in second order QCD from e^+e^--annihilation into hadrons, 9:50774 (R;DE)
Multiple bremsstrahlung in gauge theories at high energies. Pt. 4, 9:50773 (R;DE)
Jet Model
Detectors for quark and gluon jets at high energies, 9:50762 (R;DE)
Multiple Production
Model dependence of the determination of the strong coupling constant in second order QCD from e^+e^--annihilation into hadrons, 9:50774 (R;DE)
Pair Production
Evidence for local compensation of baryon number in e^+e^- annihilation, 9:50764 (R;DE)
Particle Production
Introduction to ν quarkonium physics, 9:50776 (R;DE)
Measurement of R and search for the top quark in e^+e^- annihilation between 39.8 and 45.2 GeV, 9:50763 (R;DE)
ELECTRONS
Collisions
Influence of microturbulence on early time HANE structure. Memorandum report, 9:50818 (R;US)
Energy Losses
Simulating electron energy loss fluctuations in deterministic streaming ray calculations, 9:50933 (J;US)
Mean Free Path
Arc-evaporated carbon films: optical properties and electron mean free paths, 9:50183 (R;US)
Range
Computational study of discretization error for the upwind finite-difference approximation to the Spencer-Lewis equation, 9:50932 (J;US)
ELECTROSTATIC ANALYZERS
Resolution
Calculation and computer simulation of the Paraboloidal Mirror Analyzer (PMA), 9:50746 (R;US)
ELECTROSTATIC PRECIPITATORS
Damage
Testing and evaluation of ESP at Curtiss-Wright, 9:49754 (RA;US)
Performance Testing
Performance of an electrostatic precipitator at simulated PFBC conditions, 9:49755 (RA;US)
Testing and evaluation of ESP at Curtiss-Wright, 9:49754 (RA;US)
ELECTROSTATIC WAVES
See PLASMA WAVES
ELECTROVAC EQUATIONS
See EINSTEIN-MAXWELL EQUATIONS
ELEMENT 104
Alpha Decay
Calculated masses and half-lives for nuclei in the region $100 \leqq Z \leqq 110$, 9:50905 (R;US)
Mass
Calculated masses and half-lives for nuclei in the region $100 \leqq Z \leqq 110$, 9:50905 (R;US)
Spontaneous Fission
Calculated masses and half-lives for nuclei in the region $100 \leqq Z \leqq 110$, 9:50905 (R;US)
ELEMENT 106
Alpha Decay
Calculated masses and half-lives for nuclei in the region $100 \leqq Z \leqq 110$, 9:50905 (R;US)
Mass
Calculated masses and half-lives for nuclei in the region $100 \leqq Z \leqq 110$, 9:50905 (R;US)
Spontaneous Fission
Calculated masses and half-lives for nuclei in the region $100 \leqq Z \leqq 110$, 9:50905 (R;US)
ELEMENT 108
Alpha Decay
Calculated masses and half-lives for nuclei in the region $100 \leqq Z \leqq 110$, 9:50905 (R;US)
Mass
Calculated masses and half-lives for nuclei in the region $100 \leqq Z \leqq 110$, 9:50905 (R;US)
Spontaneous Fission
Calculated masses and half-lives for nuclei in the region $100 \leqq Z \leqq 110$, 9:50905 (R;US)
ELEMENT 110
Alpha Decay
Calculated masses and half-lives for nuclei in the region $100 \leqq Z \leqq 110$, 9:50905 (R;US)
Mass
Calculated masses and half-lives for nuclei in the region $100 \leqq Z \leqq 110$, 9:50905 (R;US)
Spontaneous Fission
Calculated masses and half-lives for nuclei in the region $100 \leqq Z \leqq 110$, 9:50905 (R;US)
ELEMENTARY PARTICLES
See also HADRONS
Meetings
Elementary particle physics. Proceedings of 17. Winter school of Leningrad Institute of Nuclear Physics, 9:50760 (R;UA)
ELMO BUMPY TORUS
ECR Heating
Comparison of electron cyclotron heating theory and experiment in EBT, 9:51001 (R;US)
Mathematical Models
Theoretical investigations relevant to magnetic fusion research, 9:51003 (R;US)
Theoretical investigations relevant to magnetic fusion research, April 1, 1983-March 31, 1984, 9:51004 (R;US)
Plasma Diagnostics
Far-infrared laser diagnostic on EBT and extreme far-forward laser scattering on ISX, 9:51002 (R;US)
EMANOMETERS
Dielectric Track Detectors
Characteristics of a radon diffusion chamber with electrical collection using plastic nuclear track detectors. Open file report 31 August 1982-30 November 1983, 9:50485 (R;US)
Testing
Characteristics of a radon diffusion chamber with electrical collection using plastic nuclear track detectors. Open file report 31 August 1982-30 November 1983, 9:50485 (R;US)
EMERGENCY PLANS
Implementation
U.S. Department of Energy issues interim final rules and proposed rules on the standby Federal Emergency Energy Conservation Plan, 9:49949 (J;US)
EMISSION SPECTROSCOPY
Electric Arcs
Investigations of the double plasma arc in a graphite tube, 9:50289 (R;DE;In German)
EMITTANCE (BEAM)
See BEAM EMITTANCE
EMPLOYEES
See PERSONNEL
END USE SECTOR
See COMMERCIAL SECTOR
INDUSTRY
RESIDENTIAL SECTOR
TRANSPORTATION SECTOR
ENDF
See NUCLEAR DATA COLLECTIONS

ENDOSTEUM
See BONE TISSUES
ENERGY AUDITS
Evaluation
Energy management assistance for small and medium-size manufacturers. A third-stage evaluation of the 1981-1983 EADC program, 9:49972 (R;US)
Implementation
Implementation results and financial returns from EADCS' recommendations to conserve energy and control costs. Third phase, 1981-1983 program, 9:49971 (R;US)
Implementation results and financial returns from EADCs' recommendations to conserve energy and control costs. Second phase, 1981-1983 program, 9:49973 (R;US)
Implementation of EADCs' recommendations to conserve energy and save dollars (1981-1982), 9:49978 (R;US)
Implementation of energy conservation opportunities by small and medium-size manufacturers. Second phase, 1981-1983 EADC program, 9:49976 (R;US)
Program Management
Effectiveness assessment visits. Energy Analysis and Diagnostic Centers, October-November 1981, 9:49974 (R;US)
Energy management assistance for small and medium-size manufacturers. A first-stage evaluation of the 1981-1983 program, 9:49975 (R;US)
Program of direct energy conservation assistance for medium-size and small manufacturers. Energy Analysis and Diagnostic Centers, September 1981-September 1982, 9:49977 (R;US)
ENERGY CONSERVATION
Attitudes
Determinants of interest in new energy reduction projects among commercial and industrial ratepayers, 9:49993 (RA;US)
Segmenting markets for conservation, 9:50047 (RA;US)
Cost
Specification and cost manual for energy retrofits on small commercial and multifamily buildings, 9:49690 (R;US)
Environmental Impacts
Environmental analysis of Bonneville Power Administration - prescribed audit-based electric energy conservation measures in ten selected industries, 9:50582 (R;US)
Financial Incentives
Don't pay for insulation: buy conservation, 9:49985 (RA;US)
Post-war energy economics: the urban and regional implications, 9:49921 (RA;US)
Manuals
Specification and cost manual for energy retrofits on small commercial and multifamily buildings, 9:49690 (R;US)
Marketing
Conservation as part of a utility market plan: lessons learned, 9:50048 (RA;US)
Program Management
Conservation's value varies with view, 9:50024 (J;US)
Development of a community energy conservation program. Guide to organizing and managing a program. Volume I, 9:50065 (R;US)
Urban Self-Reliance House. Final technical report, 9:50066 (R;US)
Specifications
Specification and cost manual for energy retrofits on small commercial and multifamily buildings, 9:49690 (R;US)
Technology Impacts
Assessment of how residential passive solar systems impact utilities. Final report, 9:49686 (R;US)
ENERGY CONSUMPTION
Forecasting
Adapting state and national electricity consumption forecasting methods to utility service areas. Final report, 9:49956 (R;US)
ENERGY DISSIPATION
See ENERGY LOSSES
ENERGY EXPENSES
Social Impact
How will high energy costs affect social forms and patterns: relationships between energy-conservation, transportation, and spatial structures, 9:49922 (RA;US)
ENERGY LOSSES
Landau Fluctuations
Simulating electron energy loss fluctuations in deterministic streaming ray calculations, 9:50933 (J;US)
ENERGY MANAGEMENT
Energy management review, 9:49942 (R;US)
District Heating
Economic evaluation of a district heating plant in Trysil (Norway), 9:49925 (R;NO;In Norwegian)
Economic Analysis
Economic evaluation of a district heating plant in Trysil (Norway), 9:49925 (R;NO;In Norwegian)
ENERGY POLICY
Post-war energy economics: the urban and regional implications, 9:49921 (RA;US)
Bibliographies
Energy: a continuing bibliography with indexes, issue 40, January 1984, 9:49918 (R;US)
Environmental Impacts
Environmental assessment on Bonneville Power Administration's proposed policy for sales of nonfirm energy for service to loads with alternate fuel capability, 9:50583 (R;US)
Simulation
Stimulating energy conservation in commercial buildings: A simulation analysis of alternative policies, 9:50027 (J;GB)
ENERGY SECURITY CORPORATION
See SYNTHETIC FUELS CORPORATION
ENERGY SHORTAGES
Emergency Plans
Energy emergency preparedness. Hearings before the Subcommittee on Fossil and Synthetic Fuels of the Committee on Energy and Commerce, House of Representatives, Ninety-Eighth Congress, Second Session, February 1, 2, and 21, 1984, 9:49470 (B;US)
Low-cost approach to local government energy contingency planning, 9:49947 (R;US)
Government Policies
Energy emergency preparedness. Hearings before the Subcommittee on Fossil and Synthetic Fuels of the Committee on Energy and Commerce, House of Representatives, Ninety-Eighth Congress, Second Session, February 1, 2, and 21, 1984, 9:49470 (B;US)
ENERGY SOURCE DEVELOPMENT
Energy: challenges and opportunities for the Middle Atlantic United States. Volume 1. Summaries and discussions, 9:49945 (R;US)
Chemical Effluents
EADS (Environmental Assessment Data Systems) Liquid Effluents Data System, 1982. Annual report, 9:50571 (R;US)
Environmental Impacts
Geothermal environmental impact assessment: an approach to ground water impacts from development, conversion, and waste disposal, 9:50573 (R;US)
Radioactive Effluents
EADS (Environmental Assessment Data Systems) Liquid Effluents Data System, 1982. Annual report, 9:50571 (R;US)
ENERGY SOURCES
See also FOSSIL FUELS
NUCLEAR FUELS
RENEWABLE ENERGY SOURCES
WOOD FUELS
Comparative Evaluations
Impact of risk studies, 9:49936 (R;SE)
ENERGY STORAGE
See also COMPRESSED AIR ENERGY STORAGE
HEAT STORAGE
Photoelectrochemical Cells
Progress in the SERI-DOE Photoelectrochemical Cell Program, 9:49642 (BA;US)
ENERGY SUPPLIES
District Heating
Economic evaluation of a district heating plant in Trysil (Norway), 9:49925 (R;NO;In Norwegian)
Economic Analysis
Post-war energy economics: the urban and regional implications, 9:49921 (RA;US)

Forecasting
Energy: challenges and opportunities for the Middle Atlantic United States. Volume 1. Summaries and discussions, 9:49945 (R;US)
Mathematical Models
Cost-optimized energy supply scenarios for Switzerland and their political marginal conditions, 9:49919 (R;CH;In German)
Prices
Energy: challenges and opportunities for the Middle Atlantic United States. Volume 2. Background articles, 9:49917 (R;US)
Supply Disruption
Energy emergency preparedness. Hearings before the Subcommittee on Fossil and Synthetic Fuels of the Committee on Energy and Commerce, House of Representatives, Ninety-Eighth Congress, Second Session, February 1, 2, and 21, 1984, 9:49470 (B;US)
Wood Fuels
Economic evaluation of a district heating plant in Trysil (Norway), 9:49925 (R;NO;In Norwegian)

ENERGY YIELD
Mathematical Models
Fixed in-core detector reading analysis, 9:49776 (RA;BG;In Bulgarian)

ENERGY-LEVEL DENSITY
Fermi Gas Model
Systematics of nuclear level densities. Chapter V, 9:50866 (RA;NL)

ENGINEERING
Automation
Autos 82. Volume 2. Automation in engineering, 9:50358 (R;CS;In Czech)
Autos 82. Volume 3. Automation in engineering, 9:50371 (R;CS;CZ)
Autos 82. Volume 4. Automation in engineering, 9:50369 (R;CS;CZ)
Autos 82. Volume 1. Automation in engineering, 9:50370 (R;CS;CZ)

ENRICHED URANIUM
See also HIGHLY ENRICHED URANIUM
MODERATELY ENRICHED URANIUM
SLIGHTLY ENRICHED URANIUM
Cost Recovery
Information on repayment of the government's uranium enrichment program costs and audits of that program's financial statements, 9:49524 (R;US)
Energy Policy
Uranium enrichment policy. Hearings before the Subcommittee on Energy Conservation and Power of the Committee on Energy and Commerce, House of Representatives, Ninety-Eighth Congress, October 21, 1983 and March 1, 1984, 9:49512 (B;US)
Financial Data
Information on repayment of the government's uranium enrichment program costs and audits of that program's financial statements, 9:49524 (R;US)
Market
Uranium enrichment policy. Hearings before the Subcommittee on Energy Conservation and Power of the Committee on Energy and Commerce, House of Representatives, Ninety-Eighth Congress, October 21, 1983 and March 1, 1984, 9:49512 (B;US)

ENRICHMENT PLANTS (CENTRIFUGE)
See CENTRIFUGE ENRICHMENT PLANTS

ENVIRONMENT
Radionuclide Migration
Radioecological research on the behavior of actinides in the environment, 9:49870 (RA;DE;In German)

ENVIRONMENTAL EXPOSURE CHAMBERS
See EXPOSURE CHAMBERS

ENVIRONMENTAL MATERIALS
Use only for unspecified samples from the environment. See also specific environmental materials.
Radiochemical Analysis
Semi-annual report of the Department of Energy, Operational Safety, Health and Environment Division - Quality Assessment Program, 9:50539 (R;US)

ENVIRONMENTAL PARKS
See NATURE RESERVES

ENVIRONMENTAL POLICY
Comments on acid rain, 9:50537 (BA;US)
Radionuclide removal for small public water systems. Technical report, 9:50579 (R;US)
Decision Making
Discussion of policy issues in implementing environmental legislation, 9:49927 (R;US)

ENVIRONMENTAL PROTECTION AGENCY
See US EPA

EPA
See US EPA

EPIPHYSIS (BONES)
See BONE TISSUES

EPRI
Test Facilities
Operation of the EPRI Nondestructive Evaluation Center. 1983 annual report, 9:49933 (R;US)

EQUATIONS OF MOTION
Finite Difference Method
Gauge equivalent difference evolution equations, 9:50980 (RA;BG;In Bulgarian)
Gauge Invariance
Gauge equivalent difference evolution equations, 9:50980 (RA;BG;In Bulgarian)

EQUIPMENT
Use of a more specific term is recommended.
See also CONTROL EQUIPMENT
DRILLING EQUIPMENT
ELECTRICAL EQUIPMENT
ELECTRONIC EQUIPMENT
HEAT RECOVERY EQUIPMENT
MILITARY EQUIPMENT
MINING EQUIPMENT
OPTICAL EQUIPMENT
PARTICLE SIZE CLASSIFIERS
POLLUTION CONTROL EQUIPMENT
SAMPLERS
THERMAL ENERGY STORAGE EQUIPMENT
X-RAY EQUIPMENT
Materials
Design baseline: 6000 tpd SRC-1 Demonstration Plant. Volume 5 (revised) (SRC-1 Demonstration Plant), 9:49351 (R;US)
Specifications
Design baseline: 6000 tpd SRC-1 Demonstration Plant. Volume 4 (revised), 9:49350 (R;US)
Design baseline: 6000 tpd SRC-1 Demonstration Plant. Volume 5 (revised) (SRC-1 Demonstration Plant), 9:49351 (R;US)

EQUIPMENT PROTECTION DEVICES
Design
Protective circuit for thyristor controlled systems and thyristor converter embodying such protective circuit, 9:50424 (P;US)

ERBIUM 157
High Spin States
Partial fusion reaction and its application to high-spin spectroscopy, 9:50890 (RA;AU)

ERBIUM 158
High Spin States
Measurement of the g-factors of high-spin states in ^{158}Er, 9:50884 (RA;AU)
Partial fusion reaction and its application to high-spin spectroscopy, 9:50890 (RA;AU)
Lande Factor
Measurement of the g-factors of high-spin states in ^{158}Er, 9:50884 (RA;AU)

ERBIUM 159
High Spin States
Partial fusion reaction and its application to high-spin spectroscopy, 9:50890 (RA;AU)

ERBIUM 168
E2-Transitions
Intrinsic excitations in deformed nuclei. Characteristic predictions of the IBA, 9:50895 (BA;JP)
Interacting Boson Model
Intrinsic excitations in deformed nuclei. Characteristic predictions of the IBA, 9:50895 (BA;JP)

ERBIUM ALLOYS
Neutron Diffraction
Neutron diffraction study of the tetragonal $NpCu_4Al_8$ and $ErFe_4Al_8$ intermetallic compounds, 9:50114 (RA;IL)
ERYTHROCYTES
Multi-Element Analysis
Elemental microanalysis of individual blood cells, 9:50277 (RA;AU)
ETHANE
Adsorption Isotherms
Separation factor method for the analysis of ideal binary mixtures in gas-solid adsorption, 9:50293 (J;US)
Data Compilation
Petroleum supply monthly, July 1984, 9:49454 (R;US)
Separation Processes
Separation factor method for the analysis of ideal binary mixtures in gas-solid adsorption, 9:50293 (J;US)
1,2-ETHANEDIOL
See GLYCOLS
ETHANOL
Production
Alcohol fuel from Ohio farms, 9:49584 (R;US)
ETHANOL FUELS
Use for pure ethanol, ethanol-water mixtures, or ethanol with additives; for ethanol-gasoline mixtures, use GASOHOL.
Market
Alcohol fuel from Ohio farms, 9:49584 (R;US)
ETHANOL PLANTS
Air Pollution
Testing and evaluation of on-farm alcohol production facilities. Final report, 9:49585 (R;US)
Water Pollution
Testing and evaluation of on-farm alcohol production facilities. Final report, 9:49585 (R;US)
ETHINE
See ACETTLENE
ETHYL ALCOHOL
See ETHANOL
ETHYLENE
Catalysis
Metal-zeolite catalysts for the conversion of synthesis gas to selected hydrocarbon products, 9:49582 (BA;US)
ETHYLENE GLYCOL
See GLYCOLS
ETHYNE
See ACETTLENE
EUFLAVINE
See ACRIFLAVINE
EUROPIUM
Absorption Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Activation Analysis
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Emission Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
EUROPIUM 139
Decay
Nuclear chemistry research and spectroscopy with radioactive sources. Twentieth annual progress report, September 1, 1983-August 31, 1984, 9:50869 (R;US)
EUROPIUM 149
Electron Capture Decay
Opposing properties of particle-hole and intruder-hole bands in N = 87 nuclei and ^{149}Sm levels populated by ^{149}Pm (β^-) and ^{149}Eu(EC), 9:50881 (J;GB)
EVALUATED NUCLEAR DATA FILE
See NUCLEAR DATA COLLECTIONS
EVAPORATORS
Scaling
Study of scale and noncondensables in an evaporator. Annual report, 1 October 1983-30 September 1984, 9:49729 (R;US)
EVEN-EVEN NUCLEI
Even protons, even neutrons.
See also BARIUM 130
BARIUM 132
BARIUM 134
BARIUM 136
BARIUM 138
CALCIUM 44
CALCIUM 48
DYSPROSIUM 158
ERBIUM 158
ERBIUM 168
LEAD 200
LEAD 210
LEAD 212
MAGNESIUM 24
MERCURY 188
MERCURY 190
MERCURY 192
MERCURY 194
OSMIUM 188
OSMIUM 190
OSMIUM 192
OXYGEN 18
PLATINUM 188
POLONIUM 210
RADIUM 226
RADIUM 228
RADON 222
RADON 226
STRONTIUM 90
THORIUM 228
THORIUM 230
THORIUM 232
TUNGSTEN 168
TUNGSTEN 178
TUNGSTEN 182
URANIUM 234
URANIUM 238
YTTERBIUM 168
Interacting Boson Model
Relation between the variable moment of inertia model and the interacting boson model, 9:50924 (BA;JP)
VMI Model
Relation between the variable moment of inertia model and the interacting boson model, 9:50924 (BA;JP)
EXCHANGE (HEAT)
See HEAT TRANSFER
EXHAUST GASES
Air Pollution Control
Investigations into the emissions effects of vehicle misfueling, 9:50532 (R;US)
Chemical Properties
Chemical and biological properties of diesel exhaust particles collected during selected segments of a simulated driving cycle, 9:50640 (J;US)
Lung Clearance
Respiratory tract clearance of ^{14}C-labeled diesel exhaust compounds associated with diesel particles or as a particle-free extract, 9:50641 (J;US)
Mutagen Screening
Chemical and biological properties of diesel exhaust particles collected during selected segments of a simulated driving cycle, 9:50640 (J;US)
EXPERIMENTAL DATA
Photoelectron Spectroscopy
Vacuum ultraviolet photoionization of cold molecular beams, 9:50720 (R;US)
EXPERIMENTAL FACILITIES (ACCELERATOR)
See ACCELERATOR FACILITIES
EXPERIMENTAL NEOPLASMS
Biological Radiation Effects
Retention of incorporated radionuclides after variable application of gamma-rays, 9:50614 (R;DE;In German)
Growth
Retention of incorporated radionuclides after variable application of gamma-rays, 9:50614 (R;DE;In German)
Radiotherapy
Experimental tumor therapy annual report 1982, 9:50591 (R;DE;In German)
EXPLOSIVE FORMING
Destructive Testing
Evaluation of end-cap-less tensile specimen for explosive testing, 9:50505 (R;US)
Stress Analysis
Evaluation of end-cap-less tensile specimen for explosive testing, 9:50505 (R;US)

EXPOSURE CHAMBERS
Design
Lead uptake by perennial ryegrass and radishes from air, water and soil, 9:50650 (J;CA)
EXPOSURE (RADIATION DOSES)
See RADIATION DOSES
EXTREMELY HIGH FREQUENCY RADIATION
See MICROWAVE RADIATION
EXTRUSION
Dies
Optimization of the die entrance shape for polymeric extrusion, 9:50178 (R;US)

F

F REGION
Microwave Radiation
Multistation study of nighttime scintillations in low latitudes: evidence of control by equatorial F region irregularities, 9:50717 (J;US)
FACILITIES (ACCELERATOR)
See ACCELERATOR FACILITIES
FACILITIES (NUCLEAR)
See NUCLEAR FACILITIES
FACILITIES (RESOURCE RECOVERY)
See RESOURCE RECOVERY FACILITIES
FACILITIES (TEST)
See TEST FACILITIES
FACILITIES (UNDERWATER)
See UNDERWATER FACILITIES
FALLOUT PARTICULATES
See PARTICLES
FARMS
Ethanol Plants
Alcohol fuel from Ohio farms, 9:49584 (R;US)
Testing and evaluation of on-farm alcohol production facilities. Final report, 9:49585 (R;US)
Greenhouses
Energy on an independent farm. Final performance report, 9:49734 (R;US)
Photovoltaic Power Supplies
Energy on an independent farm. Final performance report, 9:49734 (R;US)
Solar Water Heaters
Energy on an independent farm. Final performance report, 9:49734 (R;US)
Wind-Powered Pumps
Energy on an independent farm. Final performance report, 9:49734 (R;US)
FAST REACTORS
Research Programs
Fast reactor programme. Annual progress report 1982, 9:49783 (R;NL)
FATTY ACIDS
See CARBOXYLIC ACIDS
FAULT TREE ANALYSIS
Computer Calculations
Automatic construction of failure tree for reliability analysis of nuclear power plants, 9:49858 (RA;CS;In Slovak)
FAULT TREE SYSTEMS
See FAULT TREE ANALYSIS
FEDERAL EMERGENCY MANAGEMENT AGENCY
See US FEMA
FEDERAL REGION III
Prior to June 1982 this concept was indexed to CENTRAL REGION.
Energy Conservation
Energy: challenges and opportunities for the Middle Atlantic United States. Volume 1. Summaries and discussions, 9:49945 (R;US)
Energy Supplies
Energy: challenges and opportunities for the Middle Atlantic United States. Volume 1. Summaries and discussions, 9:49945 (R;US)
FEDERAL REGION X
Prior to June 1982 this concept was indexed to PACIFIC NORTHWEST REGION.
See also ALASKA
Energy Conservation
Conservation's value varies with view, 9:50024 (J;US)
FEDERAL REPUBLIC OF GERMANY
Fuel Reprocessing Plants
Brief description of the Wackersdorf reprocessing installation, 9:49522 (TG;US)
FEDERAL WATER POLLUTION CONTROL ACT
See CLEAN WATER ACT
FEED MATERIALS PLANTS
Feasibility Studies
Mining-metallurgical projects for the production of uranium concentrates, 9:49507 (R;MX;In Spanish)
FERMENTATION ALCOHOL
See ETHANOL
FERMILAB ACCELERATOR
Facility at Fermi National Accelerator Laboratory, Batavia, Illinois, includes main synchroton, booster synchrotron, and linac.
Helium Dilution Refrigerators
Fermilab central helium liquefier operations, 9:50467 (BA;US)
Refrigerators
Fermilab's satellite refrigerator expansion engines, 9:50469 (BA;US)
Superconducting Magnets
Fermilab central helium liquefier operations, 9:50467 (BA;US)
FERMIONS
Chiral Symmetry
Path-integral derivation of the chiral anomalies of Dirac fermions coupled to gauge and gravitational fields in even space-time dimensions, 9:50813 (J;US)
Mass
Fermions in the desert, 9:50815 (BA;US)
Nonstandard fermion mass matrices and nucleon decay, 9:50789 (J;US)
Unified Gauge Models
Fermions in the desert, 9:50815 (BA;US)
Vacuum States
Quantum effects in the Schwinger model, 9:50804 (RA;BG;In Bulgarian)
FERMIUM
Alpha Decay
Calculated masses and half-lives for nuclei in the region $100 \leqq Z \leqq 110$, 9:50905 (R;US)
Mass
Calculated masses and half-lives for nuclei in the region $100 \leqq Z \leqq 110$, 9:50905 (R;US)
Spontaneous Fission
Calculated masses and half-lives for nuclei in the region $100 \leqq Z \leqq 110$, 9:50905 (R;US)
FERRIC COMPOUNDS
See IRON COMPOUNDS
FERROMAGNETIC MATERIALS
K Shell
Polarization transfer to inner-vacancies of ions swiftly traversing polarized ion hosts, 9:50730 (RA;AU)
FERROMAGNETISM
Ferromagnetism in metals at finite temperatures, 9:50945 (R;US)
FERROUS COMPOUNDS
See IRON COMPOUNDS
FIBER OPTICS
Feasibility of using fiber optics for monitoring ground water contaminants, 9:50580 (R;US)
Feasibility Studies
Feasibility of using fiber optics for monitoring groundwater contaminants, 9:50575 (J;US)
Uses
Feasibility of using fiber optics for monitoring groundwater contaminants, 9:50575 (J;US)

FIBROBLASTS
Biological Repair
Response of sensitive human Ataxia and resistant T-1 cell lines to accelerated heavy ions, 9:50627 (J;GB)
FIELD EFFECT TRANSISTORS
See also MOSFET
Production
Growth and properties of semiconductor strained-layer superlattices, 9:50186 (R;US)
FIELD-REVERSED MIRROR REACTORS
Computerized Simulation
Simulating field-reversed magnetic-mirror fusion devices, 9:51013 (J;US)
FIELDS (ELECTRIC)
See ELECTRIC FIELDS
FIELDS (ELECTROMAGNETIC)
See ELECTROMAGNETIC FIELDS
FIELDS (GRAVITATIONAL)
See GRAVITATIONAL FIELDS
FIELDS (MAGNETIC)
See MAGNETIC FIELDS
FILAMENTS
Ultrasonic Testing
Ultrasonic analysis of spherical composite test specimens, 9:50416 (R;US)
FILLER METALS
Microstructure
Microstructure of rapidly quenched type 308 stainless steel weld filler metal and its implications on rapid solidification processes, 9:50104 (R;US)
FILTERS
Efficiency
Dust filtration using ceramic fiber filter media: a state-of-the-art summary, 9:49395 (RA;US)
Performance
Response of HEPA filters to high differential pressures, 9:49869 (RA;DE;In German)
Performance Testing
Dust filtration using ceramic fiber filter media: a state-of-the-art summary, 9:49395 (RA;US)
Hot gas cleanup using porous ceramic cross flow filters, 9:49394 (RA;US)
Reactor Safety
Response of HEPA filters to high differential pressures, 9:49869 (RA;DE;In German)
FILTRATION
Research Programs
Mechanisms of cake filtration. Third progress report, Part II, September 1981-April 1984, 9:50265 (R;US)
Mechanisms of cake filtration. Second progress report, May 1982-April 1983, 9:50263 (R;US)
Mechanisms of cake filtration. Third progress report, Part I, September 1981-April 1984, 9:50264 (R;US)
Mechanisms of cake filtration. Progress report, 9:50262 (R;US)
FINGERPRINTING (OIL SPILLS)
See OIL SPILLS
PATTERN RECOGNITION
FIRE STATIONS
See PUBLIC BUILDINGS
FIREDAMP
See METHANE
FIRES
Environmental Effects
Effects of prescribed fire on water quality at the Santee Experimental Watersheds in South Carolina, 9:50545 (R;US)
Fire Fighting
Calamity Hollow Mine Fire Project. 3. Instrumentation for combustion monitoring, process control, and data recording. Report of investigations/1984, 9:49415 (R;US)
FIREWOOD
See WOOD FUELS
FIRST WALL
Interactions
Plasma surface interaction processes and possible synergisms, 9:51026 (R;US)
Performance
Wet wall cavity response in ICF reactors, 9:51032 (R;US)
FISCHER-TROPSCH SYNTHESIS
Catalysts
Use of novel catalysts founded on basic-fixed hydride-carbonyl complexed for the Fischer-Tropsch synthesis, 9:49579 (R;DE;In German)
Chemical Reaction Kinetics
Untangling the water gas shift from Fischer-Tropsch: A Gordian knot?, 9:49577 (BA;US)
FISH LADDERS
See FISH PASSAGE FACILITIES
FISH LIFTS
See FISH PASSAGE FACILITIES
FISH LOCKS
See FISH PASSAGE FACILITIES
FISH PASSAGE FACILITIES
Cost Benefit Analysis
Advanced intake technologies study. Final report, 9:49745 (R;US)
Field Tests
Advanced intake technologies study. Final report, 9:49745 (R;US)
FISHWAYS
See FISH PASSAGE FACILITIES
FISSION FRAGMENTS
Neutron Emission
Neutron emission from accelerating fission fragments, 9:50876 (RA;AU)
FISSION PRODUCT RELEASE
Coordinate with descriptors for the area of release such as BIOSPHERE or COOLANTS, and for the specific fission products, if known.
Reactor Safety
Release of radioactivity and formation of aerosols during LWR core meltdown, 9:49881 (RA;DE;In German)
FISSION PRODUCTS
Decay
NEANDC specialists meeting on yields and decay data of fission product nuclides, 9:50819 (R;US)
Radioactive Waste Processing
Off-gas treatment and characterization for a radioactive in situ vitrification test, 9:49556 (R;US)
Vitrification
Off-gas treatment and characterization for a radioactive in situ vitrification test, 9:49556 (R;US)
FISSION YIELD
Meetings
NEANDC specialists meeting on yields and decay data of fission product nuclides, 9:50819 (R;US)
FIXED BED
See PACKED BED
FLAME SPECTROMETRY
See EMISSION SPECTROSCOPY
FLAMES
Fluorescence
Saturated laser fluorescence in turbulent sooting flames at high pressure, 9:50356 (R;US)
FLAT PLATE COLLECTORS
Research Programs
Flat-plate solar array progress and plans, 9:49715 (BA;US)
Technology Assessment
Flat-plate solar array progress and plans, 9:49715 (BA;US)
FLOW (FLUID)
See FLUID FLOW
FLOW REGULATORS
See also VALVES
Design
Air-flow regulation system for a coal gasifier, 9:49365 (P;US)
FLUE GAS
Desulfurization
Coal combined cycle system study. Volume III. Concept descriptions, 9:49749 (R;US)
Failure mode analysis for lime/limestone FGD system. Volume III. Plant profiles. Part 1 of 3, 9:49401 (R;US)
Results of the first two years of commercial operation of an organic-acid-enhanced FGD (flue gas desulfurization) system. Final report April 1982-April 1984, 9:50438 (R;US)

Study of the reaction of SO_2 with $NaHCO_3$ and Na_2CO_3, 9:49403 (J;US)
Hot Gas Cleanup
APT dry plate scrubber for particulate collection at high temperature and pressure, 9:49392 (RA;US)
FLUID FLOW
See also GAS FLOW
INCOMPRESSIBLE FLOW
LAMINAR FLOW
STEADY FLOW
TWO-PHASE FLOW
Buildings
Model investigations about flow in industrial halls with heat sources, 9:50405 (R;DE;In German)
Finite Element Method
Accuracy of the finite analytic method for scalar transport calculations, 9:51048 (R;US)
Heat Sources
Model investigations about flow in industrial halls with heat sources, 9:50405 (R;DE;In German)
Heat Transfer
Convection heat transfer in the critical region of fluid mixtures. Progress report, 9:50399 (R;US)
Hydrodynamics
Hydrodynamic stability of inverted annular flow in an adiabatic simulation, 9:50407 (J;US)
Stability
Hydrodynamic stability of inverted annular flow in an adiabatic simulation, 9:50407 (J;US)
FLUID MECHANICS
Finite Element Method
Consistent method for computing derived boundary quantities when the Galerkin FEM is used to solve thermal and/or fluids problems, 9:50758 (BA;GB)
FLUIDIZED BED
Elutriation
Entrainment/elutriation in fluidization and application in drying coal, 9:49420 (R;US)
Entrainment
Entrainment/elutriation in fluidization and application in drying coal, 9:49420 (R;US)
Mathematical Models
Entrainment/elutriation in fluidization and application in drying coal, 9:49420 (R;US)
FLUIDIZED BED HEAT EXCHANGERS
Flow Rate
Transient axial solid and gas temperature profiles in the grid zone of a gas-solid fluidized bed, 9:50435 (J;US)
Gas Flow
Transient axial solid and gas temperature profiles in the grid zone of a gas-solid fluidized bed, 9:50435 (J;US)
Temperature Measurement
Transient axial solid and gas temperature profiles in the grid zone of a gas-solid fluidized bed, 9:50435 (J;US)
FLUIDIZED-BED COMBUSTION
Combustion Products
Dust filtration using ceramic fiber filter media: a state-of-the-art summary, 9:49395 (RA;US)
Hot gas cleanup using porous ceramic cross flow filters, 9:49394 (RA;US)
Testing and verification of granular bed filters for removal of particulates and alkalis, 9:49389 (RA;US)
Meetings
Fluidization 1980 conference: [summary of workshop discussions], 9:49426 (R;US)
Research Programs
Fluidized bed combustion of low-rank coals, 9:49429 (RA;US)
FLUIDIZED-BED COMBUSTORS
Combustion Kinetics
Analytical model for freeboard and in-bed limestone sulfation in fluidized-bed coal combustors, 9:49434 (J;GB)
Design
Combined fluidized bed retort and combustor, 9:49497 (P;US)
Fluidization 1980 conference: [summary of workshop discussions], 9:49426 (R;US)
Fly Ash
Use of a massive volume air sampler to collect fly ash for biological characterization, 9:50535 (J;US)
Operation
Combined fluidized bed retort and combustor, 9:49497 (P;US)
Scaling Laws
Fluidization 1980 conference: [summary of workshop discussions], 9:49426 (R;US)
FLUORANTHENE
See CONDENSED AROMATICS
FLUORESCEIN
Fluorescence
Concerning the question of the fluorescence yield of solutions, 9:50328 (TJ;US)
FLUORESCENT CONCENTRATORS
See LUMINESCENT CONCENTRATORS
FLUORIDES
See also ALUMINIUM FLUORIDES
LITHIUM FLUORIDES
MANGANESE FLUORIDES
POTASSIUM FLUORIDES
Potentiometry
Kitchensink titrations, 9:50303 (R;US)
FLUORINATED ALIPHATIC HYDROCARBONS
Electron Collisions
Electron-stimulated desorption from partially fluorinated hydrocarbon thin films: Molecules with common versus separate hydrogen and fluorine bonding sites, 9:50210 (J;US)
FLUORINE
Chemical Reaction Kinetics
Rate determination for $F + CH_4$ by real-time competitive kinetics, 9:50342 (J;NL)
Studies of the aqueous chemistry of fluorine and hypofluorous acid, 9:50306 (J;US)
Soil Chemistry
Attenuation of chemical elements in acidic leachates from coal mineral wastes by soils, 9:49407 (R;US)
FLUORINE 19 REACTIONS
Compound-Nucleus Reactions
Fission lifetimes from blocking measurements: ^{19}F bombardment of a thin tantalum crystal, 9:50892 (RA;SU)
Fusion Reactions
Neutron emission from accelerating fission fragments, 9:50876 (RA;AU)
FLUORINE FLUORIDES
See FLUORINE
FLUORINE IONS
Desorption
Electron-stimulated desorption from partially fluorinated hydrocarbon thin films: Molecules with common versus separate hydrogen and fluorine bonding sites, 9:50210 (J;US)
FLY ASH
Agglomeration
Some recent progress in acoustic agglomeration of power plant fly ash, 9:49756 (RA;US)
Chemical Composition
Particulate characterization, 9:49753 (RA;US)
Waste characterization, 9:49427 (RA;US)
Chemical Properties
Use of basin ash as fill material on dry level, 9:49396 (R;SE;In Danish)
Use of conditioned fly ash as fill material, 9:49397 (R;SE;In Danish)
Dissolution
Lung-clearance classification of radionuclides in coal fly ash, 9:49441 (J;GB)
Leaching
Waste characterization, 9:49427 (RA;US)
Mechanical Properties
Use of basin ash as fill material on dry level, 9:49396 (R;SE;In Danish)
Use of conditioned fly ash as fill material, 9:49397 (R;SE;In Danish)
Mutagen Screening
Use of a massive volume air sampler to collect fly ash for biological characterization, 9:50535 (J;US)
Particle Size
Particulate characterization, 9:49753 (RA;US)

Removal
APT dry plate scrubber for particulate collection at high temperature and pressure, 9:49392 (RA;US)
Electrostatic granular bed filter development program, 9:49391 (RA;US)
Sampling
Use of a massive volume air sampler to collect fly ash for biological characterization, 9:50535 (J;US)
Waste Disposal
Use of conditioned fly ash as fill material, 9:49397 (R;SE;In Danish)
Waste Product Utilization
Solid wastes from coal and shale: projections of waste forms and utilization potential, 9:49384 (R;US)
Use of basin ash as fill material on dry level, 9:49396 (R;SE;In Danish)
Use of conditioned fly ash as fill material, 9:49397 (R;SE;In Danish)

FMIT FACILITY
See FMIT LINAC

FMIT LINAC
Linear Accelerator at the Hanford Fusion Materials Irradiation Test Facility.
Performance
CW operation of the FMIT RFQ accelerator, 9:50448 (R;US)

FOAMS
Molding
Method and composition for molding low density desiccant syntactic foam articles, 9:50180 (P;US)

FOOD IRRADIATION
See FOOD PROCESSING

FOOD PROCESSING
Meetings
Meat symposium. The vital role of science and technology in the meat industry, 9:50613 (R;ZA)

FORAMINIFERA
Isotope Dating
Impacts of bioturbation on the age difference between benthic and planktonic foraminifera in deep sea sediments, 9:50655 (R;US)

FORESTRY
Regional Analysis
Optiflow. Description of a system for regional analysis of flow and utilization of forest raw materials, and one method of application, 9:49920 (R;SE;In Swedish)

FORESTS
Growth
Forest growth trends in the eastern United States: status report on empirical and modeling approaches, 9:50524 (R;US)
Mathematical Models
Simulating responses to expected climate change in eastern North America: applications to decision-making in the forest industry, 9:50547 (R;US)

FOSSIL FUEL RESERVES
See FOSSIL FUELS

FOSSIL FUELS
See also COAL
NATURAL GAS
OIL SANDS
OIL SHALES
PEAT
PETROLEUM
SHALE OIL
Environmental Impacts
Some aspects of understanding changes in the global carbon cycle, 9:50523 (R;US)

FOSSIL-FUEL POWER PLANTS
Air Pollution Abatement
Failure mode analysis for lime/limestone FGD system. Volume III. Plant profiles. Part 1 of 3, 9:49401 (R;US)
Availability
1982 analyses and reports: equipment availability report; component cause code report; and equipment availability report, 9:49744 (R;US)
Comparative Evaluations
Electricity production cost in coal and nuclear power plants, 9:49794 (R;DE;In German)
Cost
Cost of coal-fired plants and related equipment for environmental protection, 9:49748 (R;SE;In Swedish)
Technical reference book for the Energy Economic Data Base (EEDB) Program, 9:49791 (R;US)
Economic Analysis
Cost of coal-fired plants and related equipment for environmental protection, 9:49748 (R;SE;In Swedish)
Economics
Technical reference book for the Energy Economic Data Base (EEDB) Program, 9:49791 (R;US)
Fly Ash
Some recent progress in acoustic agglomeration of power plant fly ash, 9:49756 (RA;US)
Materials
Advanced Research and Technology Development Fossil Energy Materials Program. Quarterly progress report ending June 30, 1984, 9:50094 (R;US)
Performance
1982 analyses and reports: equipment availability report; component cause code report; and equipment availability report, 9:49744 (R;US)
Planning
New look at small power plants: an update on the environmental issues of interest to Italy, 9:49757 (R;US)
Pollution Control
Cost of coal-fired plants and related equipment for environmental protection, 9:49748 (R;SE;In Swedish)
Power Generation
1982 analyses and reports: equipment availability report; component cause code report; and equipment availability report, 9:49744 (R;US)
Size
New look at small power plants: an update on the environmental issues of interest to Italy, 9:49757 (R;US)
Steam Turbines
Thermoeconomic analysis of power plants. Final report, 9:50431 (R;US)

FOULING
Correlations
Comparison of low-rank coal ash sintering characteristics with pilot plant ash fouling tendencies, 9:49377 (R;US)

FOURIER TRANSFORMATION
Series Expansion
Asymptotic functions - Fourier transformation, 9:50979 (RA;BG;In Bulgarian)

FRACTURE MECHANICS
Integrals
Treatment of material laws for approximate J-estimation methods, 9:50111 (R;DE)

FRACTURE PROPERTIES
Electric Probes
Direct comparison of unloading compliance and potential drop techniques in J-integral testing, 9:50409 (R;US)

FRACTURE STRENGTH
See FRACTURE PROPERTIES

FRACTURE TOUGHNESS
See FRACTURE PROPERTIES

FRAGMENTS (DECAY)
See DECAY

FRAGMENTS (FISSION)
See FISSION FRAGMENTS

FRAGMENTS (PARTICLES)
See PARTICLES

FRANCIUM 211
High Spin States
High spin states in Fr nuclei, 9:50901 (RA;AU)

FRANCIUM 212
High Spin States
High spin states in Fr nuclei, 9:50901 (RA;AU)

FRANCIUM 213
High Spin States
High spin states in Fr nuclei, 9:50901 (RA;AU)

FRANCIUM 215
Alpha Decay
In-beam alpha, electron, and gamma-ray spectroscopy of ^{215}Fr, 9:50897 (R;DE)
High Spin States
In-beam alpha, electron, and gamma-ray spectroscopy of ^{215}Fr, 9:50897 (R;DE)
Internal Conversion
In-beam alpha, electron, and gamma-ray spectroscopy of ^{215}Fr, 9:50897 (R;DE)
FRASCATI TOKAMAK
See FT TOKAMAK
FREE ELECTRON LASERS
Beam Bunching
Experimental investigation of the characteristics of an ultraviolet storage ring laser, 9:50475 (R;US)
Waveguides
Uniform magnetic-field-induced free-electron laser in a waveguide, 9:50390 (R;US)
FREIGHT
See CARGO
FREONS
Crossflow Systems
Evaporation of R11/R113 mixtures at a horizontal cylinder in crossflow, 9:50402 (R;DE;In German)
Evaporation
Evaporation of R11/R113 mixtures at a horizontal cylinder in crossflow, 9:50402 (R;DE;In German)
FREQUENCY MEASUREMENT
Calibration Standards
NBS frequency measurement system from a user's viewpoint, 9:50502 (R;US)
FRESNEL LENS
Fabrication
Development of a low-cost extrusion-embossing process for a linear Fresnel lens photovoltaic concentration, 9:49626 (R;US)
FRJ-2 REACTOR
Irradiation Procedures
Fundamentals for the evaluation of irradiation experiments on enrichment reduction in the FRJ-2 (AF-Programme), 9:49837 (R;DE;In German)
FRM DEVICES (THERMONUCLEAR)
See FIELD-REVERSED MIRROR REACTORS
FT TOKAMAK
Plasma Waves
Interaction of lower hybrid waves with fast electron tails in FT, 9:50998 (RA;GB)
FUEL BUNDLES
See FUEL ELEMENT CLUSTERS
FUEL CANS
Heat Transfer
SSYST-3. Input description, 9:49873 (R;DE;In German)
Hydraulics
SSYST-3. Input description, 9:49873 (R;DE;In German)
Thermal Stresses
SSYST-3. Input description, 9:49873 (R;DE;In German)
FUEL CELLS
See also ACID ELECTROLYTE FUEL CELLS
Chemical Reaction Kinetics
Rotating disk electrode apparatus for the study of fuel cell reactions at elevated temperatures and pressures, 9:49966 (J;US)
Cogeneration
Study of pipeline applications of fuel cells. Final report, 9:49961 (R;US)
Computerized Simulation
Manual of phosphoric acid fuel cell power plant cost model and computer program. Final report, 9:49965 (R;US)
Cost
Manual of phosphoric acid fuel cell power plant cost model and computer program. Final report, 9:49965 (R;US)
Economic Analysis
Manual of phosphoric acid fuel cell power plant cost model and computer program. Final report, 9:49965 (R;US)
Study of pipeline applications of fuel cells. Final report, 9:49961 (R;US)
FUEL ECONOMY
Meetings
Fuel savings by advanced vehicle drive systems, 9:50076 (R;DD;In German)
Program Management
History and description of the EPA (Environmental Protection Agency) motor vehicle fuel economy program. Technical report, 9:50015 (R;US)
Regulations
Estimate of changes to fuel economy label values resulting from the proposed mid-year label updating. Technical report, 9:50016 (R;US)
FUEL ELEMENT CLUSTERS
Deformation
Heat transfer in rod bundles with severe clad deformations, 9:49871 (R;DE)
Heat Transfer
Heat transfer in rod bundles with severe clad deformations, 9:49871 (R;DE)
FUEL ELEMENTS
See also FUEL RODS
SPENT FUEL ELEMENTS
Fabrication
710 reactor program. Progress report No. 17, 9:49784 (R;US)
Performance Testing
710 reactor program. Progress report No. 17, 9:49784 (R;US)
FUEL FEEDING SYSTEMS
See also STOKERS
Technology Assessment
Assessment of feedability of Kerr-McGee ash concentrate, 9:49345 (R;US)
FUEL GAS
See also NATURAL GAS
Cooling
Heat exchanger for coal gasification process, 9:49364 (P;US)
Desulfurization
Contaminant control in hot coal derived gas streams: proceedings, 9:49388 (R;US)
Development of a hot gas cleanup system for integrated coal gasification/molten carbonate fuel cell power plants, 9:49341 (RA;US)
H_2S removal using mixed metal oxides and HCl removal using molten alkali carbonates, 9:49342 (RA;US)
Metal/metal oxides as high temperature desulfurization sorbents, 9:49338 (RA;US)
Zinc ferrite hydrogen sulfide absorbent, 9:49340 (RA;US)
Hot Gas Cleanup
Contaminant control in hot coal derived gas streams: proceedings, 9:49388 (R;US)
Design and development of a high temperature particle separator for particle control in coal gasification plants, 9:49344 (RA;US)
Development of a hot gas cleanup system for integrated coal gasification/molten carbonate fuel cell power plants, 9:49341 (RA;US)
Equilibrium measurements for the absorption of H_2S, COS and HCl by alkali metal carbonates, 9:49368 (J;US)
H_2S removal using mixed metal oxides and HCl removal using molten alkali carbonates, 9:49342 (RA;US)
Hot-gas chloride cleanup for molten carbonate fuel cells, 9:49339 (RA;US)
Overview to DOE/Fossil Energy's gas stream contaminant control program, 9:49336 (RA;US)
Zinc ferrite hydrogen sulfide absorbent, 9:49340 (RA;US)
Impurities
Update of the sulfur tolerance of molten carbonate fuel cells, 9:49964 (RA;US)
FUEL OILS
See also RESIDUAL FUELS
Data Compilation
Petroleum supply monthly, July 1984, 9:49454 (R;US)
Prices
State Energy Price System: 1982 update, 9:49952 (R;US)
Sales
Petroleum marketing monthly, July 1984, 9:49455 (R;US)

FUEL PELLETS
Dissolution
Dissolution of unirradiated UO_2-pellets in nitric acid, 9:49521 (R;DE;In German)
FUEL REPROCESSING PLANTS
Design
Brief description of the Wackersdorf reprocessing installation, 9:49522 (TG;US)
Maintenance
Dual arm master controller concept, 9:49515 (R;US)
Off-Gas Systems
Modelling of the off-gas-cleaning system of the planned reprocessing plant as a basis for a safety analysis, 9:49520 (RA;DE;In German)
FUEL RODS
Failures
Austrian contributions to fuel rod failure models shown at the International Standard Problem ISP-14 (BALON-2A code), 9:49896 (R;AT;In German)
Performance Testing
Performance analysis of VVER-type fuel rods with the STOFFEL-1 computer code, 9:49778 (R;DD)
Thermal Conductivity
To approximate thermal simulation of fuel rods with power peaking, 9:49815 (R;SU;In Russian)
FUEL SHEATHS
See FUEL CANS
FUEL SLUGS
See FUEL RODS
FUEL SLURRIES
Chemical Preparation
Coal-water slurry preparation, 9:49421 (RA;US)
Low-rank coal/water slurry combustion, 9:49430 (RA;US)
Combustion
Low-rank coal/water slurry combustion, 9:49430 (RA;US)
Level Indicators
High pressure liquid level monitor, 9:49424 (P;US)
FUEL SUSPENSIONS
See FUEL SLURRIES
FUEL-CLADDING INTERACTIONS
Reactor Safety
Chemical interactions between UO_2 and zircaloy-4 from 1000 to 2000°C, 9:49867 (RA;DE;In German)
Investigations on temperature escalation under severe fuel damage conditions, 9:49880 (RA;DE;In German)
FUEL-COOLANT INTERACTIONS
Research Programs
Scientific work of Leonardo Caldarola, 9:49884 (R;DE;In German)
FUELS (NUCLEAR)
See NUCLEAR FUELS
FUELWOOD
See WOOD FUELS
FUMES
See AEROSOLS
FUNDAMENTAL PARTICLES
See ELEMENTARY PARTICLES
FURNACES
See also GAS FURNACES
Combustion Properties
Use of furnace curtains to reduce energy consumption in glass annealing furnaces, 9:50055 (R;US)
Curtains
Use of furnace curtains to reduce energy consumption in glass annealing furnaces, 9:50055 (R;US)
Economics
Small coal furnaces: the neglected option, 9:49425 (RA;US)
Feasibility Studies
Small coal furnaces: the neglected option, 9:49425 (RA;US)
Field Tests
Medium efficiency non-condensing furnace field study - installation report - report No. 9A, 9:50013 (R;CA)
FUSED SALTS
See MOLTEN SALTS
FUSION REACTIONS
Catalysis
Experimental study of muon-catalyzed fusion in low-density deuterium-tritium gas, 9:50752 (J;US)
FUSION REACTORS
See THERMONUCLEAR REACTORS
FUSION (WELDING)
See WELDING

G

GADOLINIUM BORIDES
Thermionic Emission
Thermionic emission and vaporization behavior of the ternary systems of lanthanum hexaboride containing molybdenum boride, molybdenum diboride, zirconium diboride, gadolinium hexaboride, and neodymium hexaboride, 9:50168 (J;US)
GALLIUM ARSENIDE SOLAR CELLS
Fabrication
Ultrathin GaAs and AlGaAs solar cells, 9:49652 (BA;US)
GALLIUM ARSENIDES
Growth and properties of semiconductor strained-layer superlattices, 9:50186 (R;US)
Annealing
Laser-induced surface defects, 9:50252 (BA;NL)
Picosecond laser-induced surface transformations in solids, 9:50253 (BA;NL)
Carrier Lifetime
Subnanosecond time-resolved emission study of Cu_2O and GaAs, 9:50203 (R;US)
Compression
Quantum size effects in GaAs/GaAs/sub x/P_1/sub -x/ strained-layer superlattices, 9:50206 (J;US)
Electrical Properties
Transport properties of n-type metalorganic chemical-vapor-deposited Al/sub x/Ga/sub 1-x/As (0< or =x< or =0.6), 9:50213 (J;US)
Holes
Quantum size effects in GaAs/GaAs/sub x/P_1/sub -x/ strained-layer superlattices, 9:50206 (J;US)
Ion Channeling
Measurements of disorder distributions in GaAs using He^+ ion channeling, 9:50192 (RA;AU)
Thermal migration of tin into gallium arsenide, 9:50284 (RA;AU)
Ion Implantation
Method of light ion backscattering combined with channeling for analysis of radiation damage types in implanted gallium arsenide, 9:50195 (RA;SU;In Russian)
Residual damage in GaAs annealed layers bombarded by silicon ions, 9:50199 (RA;SU;In Russian)
Ion Scattering Analysis
Internal monitor in Rutherford scattering, 9:50737 (RA;SU;In Russian)
Photoluminescence
Quantum size effects in GaAs/GaAs/sub x/P_1/sub -x/ strained-layer superlattices, 9:50206 (J;US)
Subnanosecond time-resolved emission study of Cu_2O and GaAs, 9:50203 (R;US)
Physical Radiation Effects
Investigation of semiconductor materials proton damage by radiography, 9:50198 (RA;SU;In Russian)
Laser-induced surface defects, 9:50252 (BA;NL)
Method of light ion backscattering combined with channeling for analysis of radiation damage types in implanted gallium arsenide, 9:50195 (RA;SU;In Russian)
Picosecond laser-induced surface transformations in solids, 9:50253 (BA;NL)
Residual damage in GaAs annealed layers bombarded by silicon ions, 9:50199 (RA;SU;In Russian)
PIXE Analysis
Thermal migration of tin into gallium arsenide, 9:50284 (RA;AU)
Roughness
Quantum size effects in GaAs/GaAs/sub x/P_1/sub -x/ strained-layer superlattices, 9:50206 (J;US)

Scanning Electron Microscopy
Thermal migration of tin into gallium arsenide, 9:50284 (RA;AU)
Superlattices
Quantum size effects in GaAs/GaAs/sub x/P_1/sub -x/ strained-layer superlattices, 9:50206 (J;US)
Surface Properties
Picosecond laser-induced surface transformations in solids, 9:50253 (BA;NL)
X-Ray Fluorescence Analysis
Thermal migration of tin into gallium arsenide, 9:50284 (RA;AU)

GALLIUM PHOSPHIDES
Holes
Quantum size effects in GaAs/GaAs/sub x/P_1/sub -x/ strained-layer superlattices, 9:50206 (J;US)
Photoluminescence
Quantum size effects in GaAs/GaAs/sub x/P_1/sub -x/ strained-layer superlattices, 9:50206 (J;US)
Physical Radiation Effects
Investigation of semiconductor materials proton damage by radiography, 9:50198 (RA;SU;In Russian)
Roughness
Quantum size effects in GaAs/GaAs/sub x/P_1/sub -x/ strained-layer superlattices, 9:50206 (J;US)
Superlattices
Quantum size effects in GaAs/GaAs/sub x/P_1/sub -x/ strained-layer superlattices, 9:50206 (J;US)

GALLSTONES
See CALCULI

GAMMA DETECTION
Ge Semiconductor Detectors
Guide and instructions for determining γ-ray emission rates with germanium detector systems, 9:50487 (TG;AU)

GAMMA RADIATION
Backscattering
SKYSHINE-P: a point kernel computer program for calculating SKYSHINE exposure rates, 9:50929 (R;TW;CH)

GAMMA SOURCES
For cosmic sources of gamma radiation use COSMIC GAMMA SOURCES.
Spatial Dose Distributions
Exposition index calculation from different points in a gamma sterilization plant radiation room, 9:50935 (R;MX;In Spanish)

GAMMA SPECTROSCOPY
Reviews
Guide and instructions for determining γ-ray emission rates with germanium detector systems, 9:50487 (TG;AU)

GAS BURNERS
Efficiency
Combustion efficiency optimization manual for operators of oil- and gas-fired boilers. Final report, 9:50433 (R;US)
Manuals
Combustion efficiency optimization manual for operators of oil- and gas-fired boilers. Final report, 9:50433 (R;US)
Operation
Combustion efficiency optimization manual for operators of oil- and gas-fired boilers. Final report, 9:50433 (R;US)

GAS CONDENSATES
Chemical Analysis
Downhole sampling of geopressured gas wells. Final report, June 1982-July 1984, 9:49477 (R;US)

GAS ENGINES
See INTERNAL COMBUSTION ENGINES

GAS FIELDS
See NATURAL GAS FIELDS

GAS FLOW
See also AIR FLOW
Compressible Flow
Front tracking for gas dynamics, 9:50398 (R;US)
Dynamics
Front tracking for gas dynamics, 9:50398 (R;US)
Two-Dimensional Calculations
Front tracking for gas dynamics, 9:50398 (R;US)

GAS FURNACES
Curtains
Demonstration of furnace curtains to reduce heat energy. Final report, 9:50054 (R;US)
Field Tests
High efficiency condensing furnace field study, final report (project report No. 3B), 9:50014 (R;CA)
Season interim performance report on the field operation of a residential space heating system, 1982/1983 (project report No. 6B), 9:49490 (R;CA)

GAS HYDRATES
Chemical Composition
In-situ hydrate thermal measurements. Project status, 9:49489 (R;US)
Dissociation
Laboratory analysis of gas hydrate cores for evaluation of reservoir conditions. Final report, 9:49488 (R;US)
Enthalpy
Laboratory analysis of gas hydrate cores for evaluation of reservoir conditions. Final report, 9:49488 (R;US)
Research Programs
In-situ hydrate thermal measurements. Project status, 9:49489 (R;US)
Synthesis
Laboratory analysis of gas hydrate cores for evaluation of reservoir conditions. Final report, 9:49488 (R;US)

GAS LASERS
See also CARBON DIOXIDE LASERS
Beam Shaping
Beam shaping for CW laser recrystallization of polysilicon films, 9:50224 (BA;NL)
Townsend Discharge
Study of avalanche discharge lasers. Final technical report 1 July 1975-30 September 1983, 9:50391 (R;US)

GAS TRACK DETECTORS
Holography
Application of holography in trace detectors of high resolution, 9:50478 (RA;BG;In Bulgarian)
Reviews
Application of holography in trace detectors of high resolution, 9:50478 (RA;BG;In Bulgarian)

GAS TURBINE ENGINES
Fatigue
Elevated temperature biaxial fatigue, 9:50079 (R;US)
Materials Testing
Development of a simplified procedure for cyclic structural analysis, 9:50078 (R;US)

GAS TURBINES
Cogeneration
Gas turbine topping cycle industrial cogeneration system. Annual report January-December 1983, 9:50058 (R;US)
Corrosion
Hot corrosivity of coal conversion product on high temperature alloys. Final report, 9:50109 (R;US)
Fuel Gas
Overview to DOE/Fossil Energy's gas stream contaminant control program, 9:49336 (RA;US)
Materials Testing
High temperature gas turbine engine component materials testing program. Monthly technical progress report No. 5, November 1-29, 1975, 9:49328 (R;US)
Topping Cycles
Gas turbine topping cycle industrial cogeneration system. Annual report January-December 1983, 9:50058 (R;US)

GAS WELLS
See NATURAL GAS WELLS

GASEOUS DIFFUSION PROCESS
Financial Data
Information on repayment of the government's uranium enrichment program costs and audits of that program's financial statements, 9:49524 (R;US)

GASOLINE
Data Compilation
Petroleum supply monthly, July 1984, 9:49454 (R;US)
Prices
State Energy Price System: 1982 update, 9:49952 (R;US)
Sales
Petroleum marketing monthly, July 1984, 9:49455 (R;US)

GASOLINE ENGINES
See INTERNAL COMBUSTION ENGINES

GEL PERMEATION CHROMATOGRAPHY
Calibration
Synthesis of oligomeric models of coal derived materials for use with GPC calibration. Quarterly report, June 1984-September 1984, 9:49353 (R;US)
Standards
Synthesis of oligomeric models of coal derived materials for use with GPC calibration. Quarterly report, June 1984-September 1984, 9:49353 (R;US)
GENERATORS (AEROSOL)
See AEROSOL GENERATORS
GENERATORS (ELECTRIC)
See ELECTRIC GENERATORS
GENERATORS (STEAM)
See STEAM GENERATORS
GEOCHEMISTRY
Mathematical Models
Validation of geochemical models, 9:50667 (R;US)
GEOLOGIC STRUCTURES
Fractures
Identification and characterization of major structural discontinuities within the Eye-Dashwa lakes granite, Atikokan, N.W. Ontario, 9:50658 (RA;CA)
Geologic History
Compound structural history of Sweetgrass arch, northwestern Montana, 9:50662 (J;US)
Tectonics
Compound structural history of Sweetgrass arch, northwestern Montana, 9:50662 (J;US)
GEOPRESSURED SYSTEMS
Sampling
Downhole sampling of geopressured gas wells. Final report, June 1982-July 1984, 9:49477 (R;US)
GEOTHERMAL ENERGY
Environmental Impacts
Geothermal environmental impact assessment: an approach to ground water impacts from development, conversion, and waste disposal, 9:50573 (R;US)
Meetings
Proceedings: eighth annual geothermal conference and workshop, 9:49721 (R;US)
GEOTHERMAL ENERGY CONVERSION
Meetings
Proceedings: eighth annual geothermal conference and workshop, 9:49721 (R;US)
GEOTHERMAL FLUIDS
Corrosive Effects
Evaluation of the three-point method to measure corrosion rates, 9:49730 (J;US)
GEOTHERMAL INDUSTRY
Government Policies
Geothermal energy development in Nevada's Great Basin. Hearing before the Subcommittee on Energy and Mineral Resources of the Committee on Energy and Natural Resources, United States Senate, Ninety-Eighth Congress, Second Session, April 17, 1984, 9:49728 (B;US)
Meetings
Proceedings: eighth annual geothermal conference and workshop, 9:49721 (R;US)
GEOTHERMAL RESOURCES
Energy Source Development
Geothermal energy development in Nevada's Great Basin. Hearing before the Subcommittee on Energy and Mineral Resources of the Committee on Energy and Natural Resources, United States Senate, Ninety-Eighth Congress, Second Session, April 17, 1984, 9:49728 (B;US)
GEOTHERMAL SYSTEMS
See also HOT-DRY-ROCK SYSTEMS
HYDROTHERMAL SYSTEMS
Geophysical Surveys
Geophysical studies of active geothermal systems in the Northern Basin and Range, 9:49725 (BA;US)
Rock-Fluid Interactions
Compilation of thermodynamic data on water-mineral equilibria in hydrothermal reservoirs. Final report, 9:49731 (R;LU;In French)
GERMAN FEDERAL REPUBLIC
See FEDERAL REPUBLIC OF GERMANY
GERMAN FR ORGANIZATIONS
See also KERNFORSCHUNGSZENTRUM KARLSRUHE
Research Programs
Report of the expert committee Nuclear physics and heavy ion research 1980-1982, 9:50822 (R;DE;In German)
GERMANIUM
Annealing
Segregation and crystallization phenomena in germanium, 9:50153 (BA;NL)
Binding Energy
Surface core-level shifts for Ge(100)-(2 x 1), 9:50151 (J;GB)
Chemical Bonds
Charged dangling bonds and crystallization in group IV semiconductors, 9:50245 (BA;NL)
Crystallization
Charged dangling bonds and crystallization in group IV semiconductors, 9:50245 (BA;NL)
Explosive crystallization in a-Ge and a-Si: a review, 9:50243 (BA;NL)
Ion Implantation
Morphological instabilities and ion beam mixing in Ge. Revision, 9:50099 (R;US)
Segregation and crystallization phenomena in germanium, 9:50153 (BA;NL)
Solid-State Plasma
Optically induced intervalence-band transitions in germanium by the absorption of 1.06 μm picosecond pulses, 9:50943 (R;US)
GERMANIUM ALLOYS
Structural Chemical Analysis
Structural studies of amorphous Mo-Ge alloys using synchrotron radiation, 9:50110 (R;US)
GERMANY (FEDERAL REPUBLIC)
See FEDERAL REPUBLIC OF GERMANY
GETTERS
Materials used for the purification of vacuum atmospheres; see also the specific materials.
Performance Testing
High-temperature removal of alkali vapors in hot-gas cleaning systems, 9:49343 (RA;US)
GIANT RESONANCE
Comment on '(p,n) and (n,p) reactions as probes of isovector giant monopole resonances', 9:50917 (R;AU)
Isospin
Photonuclear reactions in light nuclei, 9:50830 (RA;AU)
Particle-Hole Model
Particle-hole description of the nuclear giant dipole resonance in light-to-medium nuclei, 9:50907 (RA;AU)
GKT PROCESS
Fuel Feeding Systems
Assessment of feedability of Kerr-McGee ash concentrate, 9:49345 (R;US)
GLASS
See also BOROSILICATE GLASS
PHOSPHATE GLASS
Activation Analysis
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Chemical Analysis
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Fabrication
Fabrication of SiC whiskers and composites, 9:50174 (R;US)
Nuclear Reaction Analysis
Studies of obsidian and glass via the nuclear microprobe and sodium depth profiles, 9:50286 (RA;AU)
Stresses
Internal stresses, 9:50255 (BA;FR)
GLASS INDUSTRY
Energy Conservation
Use of furnace curtains to reduce energy consumption in glass annealing furnaces, 9:50055 (R;US)
GLASSY METALS
See METALLIC GLASSES
GLAUBER'S SALT
See SODIUM SULFATES

GLUONS
Coupling Constants
Experimental test of the flavor independence of the quark-gluon coupling constant, 9:50765 (R;DE)
Propagator
Gluon propagator in quantum chromodynamics, 9:50806 (RA;AU)
GLYCOLS
Photon Transport
Vacuum ultraviolet electronic properties of liquids. Annual progress report, February 1, 1984-January 31, 1985, 9:50927 (R;US)
GOBAR GAS
See METHANE
GOLD
Activation Analysis
Neutron activation analysis on a series of human gallstones, 9:50272 (RA;AU)
Annealing
Laser-induced surface defects, 9:50252 (BA;NL)
Charged-Particle Transport
Angular dependence of helium ion energy losses in gold, 9:50931 (RA;SU;In Russian)
Fabrication
Evaluation of target purity using various vacuum systems, 9:50460 (R;US)
Friction
Frictional and morphological properties of Au-MoS2 films sputtered from a compact target, 9:50204 (R;US)
Ion Implantation
Morphological instabilities and ion beam mixing in Ge. Revision, 9:50099 (R;US)
Microstructure
Frictional and morphological properties of Au-MoS2 films sputtered from a compact target, 9:50204 (R;US)
Physical Radiation Effects
Laser-induced surface defects, 9:50252 (BA;NL)
Work Functions
Edge states and quantized Hall conductivity in a periodic potential, 9:50144 (J;US)
GOLD 197 TARGET
Carbon 13 Reactions
Yrast states and isomers in ^{206}At, 9:50899 (RA;AU)
Neutron Reactions
Analysis of n + ^{197}Au cross sections for E/sub n/ = 0.01-20 MeV, 9:50902 (R;US)
GOLD ALLOYS
Grain Boundaries
Atomistic studies of grain boundaries with segregated impurities. Final progress report, July 1983-June 30, 1984, 9:50108 (R;US)
GOLD ISOTOPES
High Spin States
Bose-fermi U(6/2j+1) supersymmetries and high spin anomalies, 9:50903 (R;AU)
Interacting Boson Model
Bose-fermi U(6/2j+1) supersymmetries and high spin anomalies, 9:50903 (R;AU)
GOLDSTONE BOSONS
Long-range interaction related to exchange by massless Goldstone particles and methods of its detection, 9:50784 (RA;SU;In Russian)
GRADED BAND GAP SOLAR CELLS
See CASCADE SOLAR CELLS
GRAIN ALCOHOL
See ETHANOL
GRAIN BOUNDARIES
Atomistic studies of grain boundaries with segregated impurities. Final progress report, July 1983-June 30, 1984, 9:50108 (R;US)
GRAND UNIFIED THEORY
Fermions in the desert, 9:50815 (BA;US)
CP Invariance
Hypercolor unification without cosmological domains, 9:50812 (J;US)
GRANITES
Heat Transfer
Spent fuel test - Climax: technical measurements. Interim report, Fiscal Year 1983, 9:49560 (R;US)
Radiation Doses
Spent fuel test - Climax: technical measurements. Interim report, Fiscal Year 1983, 9:49560 (R;US)
Thermal Stresses
Spent fuel test - Climax: technical measurements. Interim report, Fiscal Year 1983, 9:49560 (R;US)
GRANULAR BED FILTERS
Flow Models
Interstitial flow intensification within packed granular bed filters: Experiments and theory, 9:50439 (J;US)
Mechanical Efficiency
Interstitial flow intensification within packed granular bed filters: Experiments and theory, 9:50439 (J;US)
Performance Testing
Electrostatic granular bed filter development program, 9:49391 (RA;US)
High-temperature moving bed granular filter development at Combustion Power Company, 9:49390 (RA;US)
Testing and verification of granular bed filters for removal of particulates and alkalis, 9:49389 (RA;US)
GRANULOCYTES
See LEUKOCYTES
GRAPES
Solar Drying
Drying grapes with solar energy, 9:49682 (R;DE;In German)
GRAPHITE
Neutron Transport
Theoretical and experimental investigation on neutron transport in moderating and shielding materials, 9:50930 (RA;BG;In Bulgarian)
Sputtering
Enhanced sputtering of graphite at high temperature, 9:50718 (R;US)
GRAPHITE MODERATOR
See GRAPHITE
GRAVITATION
Quantization
Gravity as a dynamical consequence of the strong, weak, and electromagnetic interactions, 9:50977 (BA;US)
Quantum Field Theory
Quantum field theory in gravitational background, 9:50704 (R;AT)
Scale Invariance
Gravity as a dynamical consequence of the strong, weak, and electromagnetic interactions, 9:50977 (BA;US)
GRAVITATIONAL FIELDS
Mathematical Models
Theory of gravitational field, 9:50959 (RA;BG;In Bulgarian)
Measuring Methods
Superfluid ^{3}He. Neutral currents, T invariance, gravitation, 9:50755 (RA;SU;In Russian)
Quantization
Stochastic quantization of the linearized gravitational field, 9:50975 (R;AT)
GREAT BASIN
Geothermal Exploration
Geophysical studies of active geothermal systems in the Northern Basin and Range, 9:49725 (BA;US)
Geothermal Systems
Geophysical studies of active geothermal systems in the Northern Basin and Range, 9:49725 (BA;US)
Magnetotelluric Surveys
Resistivity structure of the Northern Basin and Range, 9:49726 (BA;US)
Resistivity Surveys
Resistivity structure of the Northern Basin and Range, 9:49726 (BA;US)
Seismology
Seismological investigations of volcanic and tectonic processes in the Western Great Basin, Nevada and Eastern California, 9:49727 (BA;US)

Stratigraphy
Resistivity structure of the Northern Basin and Range, 9:49726 (BA;US)
Volcanic Regions
Seismological investigations of volcanic and tectonic processes in the Western Great Basin, Nevada and Eastern California, 9:49727 (BA;US)
GREENHOUSES
Energy on an independent farm. Final performance report, 9:49734 (R;US)
Double Glazing
Conserving energy in Ohio glass greenhouses. Final report, March 1, 1978-December 31, 1980, 9:50000 (R;US)
Energy Conservation
Conserving energy in Ohio glass greenhouses. Final report, March 1, 1978-December 31, 1980, 9:50000 (R;US)
GREENLAND
Hydroelectric Power Plants
Glacial-hydrological conditions in Nordbosoe basin, Johan Dahl Land (Greenland), 9:49596 (R;DK;In Danish)
GROHNDE REACTOR
Grohnde, Niendersachsen, Federal Republic of Germany
Quality Assurance
Detrimental effects of subsequent increases in the safety and quality requirements using the Grohnde nuclear power station as an example, 9:49857 (RA;DE;In German)
GROUND SUBSIDENCE
Monitoring
Subsidence monitoring in conjunction with methane gas production in Louisiana (phase 1, deep well program). Annual report November 1981-January 1983, 9:49481 (R;US)
GROUND WATER
Chemical Analysis
Feasibility of using fiber optics for monitoring groundwater contaminants, 9:50575 (J;US)
Contamination
Feasibility of using fiber optics for monitoring groundwater contaminants, 9:50575 (J;US)
Geothermal environmental impact assessment: an approach to ground water impacts from development, conversion, and waste disposal, 9:50573 (R;US)
Distillation
Purification of tritium-free water, 9:50353 (R;PK)
Environmental Transport
Development of numerical simulation models for vertical solute transport in unsaturated soils and unconsolidated sediments, 9:50554 (R;DE;In German)
Isotope Ratio
Uranium series disequilibrium measurements at MOL and Whiteshell. Annual progress report for 1983, 9:49530 (R;GB)
Mass Transfer
Development of numerical simulation models for vertical solute transport in unsaturated soils and unconsolidated sediments, 9:50554 (R;DE;In German)
Purification
Purification of tritium-free water, 9:50353 (R;PK)
Radioactivity
Feasibility of the use of nuclear-emulsion techniques in the study of drill core and water samples from the Monticello mill, Monticello, Utah, 9:49568 (R;US)
Radionuclide Migration
Assessment of the radiological consequences of releases to groundwater following a core-melt accident at the Sizewell PWR, 9:49848 (R;GB)
Programme of research into the management and storage of radioactive waste. Fracture hydrology - Cornwall. Annual report 1983, 9:49527 (R;GB)
Programme of research into the management and storage of radioactive waste. Radionuclide source term and migration. Annual report 1983, 9:49528 (R;GB)
Programme of research into the management and storage of radioactive waste. Mathematical modelling. Annual report 1983, 9:49529 (R;GB)
Programme of research into the management and storage of radioactive waste. Aqueous phase transport through granitic rocks. Annual report 1983, 9:49531 (R;GB)
Programme of research into the management and storage of radioactive waste. Single fracture experiment at Chalk River. Annual progress report for 1983, 9:49533 (R;GB)
Radionuclide source term and migration. Progress report April 1983 - September 1983, 9:49526 (R;GB)
Uranium series disequilibrium measurements at MOL and Whiteshell. Annual progress report for 1983, 9:49530 (R;GB)
Sampling
Feasibility of using fiber optics for monitoring groundwater contaminants, 9:50575 (J;US)
Water Pollution
Waste disposal sites and their effect on the quality of ground water: a study of literature, 9:50570 (R;NL;In Dutch)
GROUND-WATER RESERVES
See AQUIFERS
GULF OF ALASKA
Natural Gas Deposits
Outer Continental Shelf oil and gas activities in the Gulf of Alaska and their onshore impacts. Gulf of Alaska summary report update, May 1984, 9:49449 (R;US)
Petroleum Deposits
Outer Continental Shelf oil and gas activities in the Gulf of Alaska and their onshore impacts. Gulf of Alaska summary report update, May 1984, 9:49449 (R;US)
GYROTRONS
See MICROWAVE AMPLIFIERS

H

HADRON REACTIONS
Glauber Theory
Medium energy probes and the IBM, 9:50915 (R;US)
Interacting Boson Model
Medium energy probes and the IBM, 9:50915 (R;US)
Multiple Scattering
Medium energy probes and the IBM, 9:50915 (R;US)
HADRON-HADRON INTERACTIONS
Elastic Scattering
Cross sections and multiplicity of charged particles scattered at high energies, 9:50780 (RA;BG;In Bulgarian)
Multiple Production
Cross sections and multiplicity of charged particles scattered at high energies, 9:50780 (RA;BG;In Bulgarian)
HADRONS
Multiple Production
Cross sections and multiplicity of charged particles scattered at high energies, 9:50780 (RA;BG;In Bulgarian)
Phase Transformations
Quark hadron phase transition in bianchi type I cosmologies, 9:50672 (R;IT)
Rest Mass
Hadron spectrum in lattice QCD, 9:50775 (R;DE)
HALIDES
See also FLUORIDES
Potentiometry
Kitchensink titrations, 9:50303 (R;US)
HAM
See MEAT
HANDLING (DATA)
See DATA PROCESSING
HANFORD RESERVATION
Radioactive Waste Facilities
Nuclear waste repository in basalt: preliminary socioeconomic assessment, 9:49558 (R;US)
HARD FACING
Materials
Evaluation of low-cobalt alloys for hardfacing applications in nuclear components. Final report, 9:49803 (R;US)
HARD SURFACING
See HARD FACING
HARMONIC OSCILLATORS
What are squeezed states really like, 9:50968 (R;US)

HAWAII
Ocean Thermal Power Plants
OTEC pilot plant for Kahe Point, Hawaii, 9:49680 (BA;US)
HAZARDOUS MATERIALS
Not for radioactive materials.
Combustion
Incineration of hazardous and low-level radioactive waste by a small generator. Final report, 9:49564 (R;US)
Environmental Exposure
Inhalation pathway risk assessment of hazardous waste incineration facilities, 9:50636 (R;US)
Radioactive Waste Processing
Incineration of hazardous and low-level radioactive waste by a small generator. Final report, 9:49564 (R;US)
HCDA
See REACTOR CORE DISRUPTION
HD 8077
See NICKEL BASE ALLOYS
HDO
See HEAVY WATER
HE-3 COUNTERS
Accuracy
High position resolution and accuracy in ^{3}He two-dimensional thermal neutron PSDs, 9:50489 (BA;GB)
Spatial Resolution
High position resolution and accuracy in ^{3}He two-dimensional thermal neutron PSDs, 9:50489 (BA;GB)
HEALTH PHYSICS
See RADIATION PROTECTION
HEAT DISSIPATION
See HEAT TRANSFER
HEAT DISTRIBUTION SYSTEMS
Economic Analysis
Economic evaluation of a district heating plant in Trysil (Norway), 9:49925 (R;NO;In Norwegian)
Wood Fuels
Economic evaluation of a district heating plant in Trysil (Norway), 9:49925 (R;NO;In Norwegian)
HEAT ENGINES
See also INTERNAL COMBUSTION ENGINES
SOLAR HEAT ENGINES
Manufacturers
Survey of manufacturers of high-performance heat engines adaptable to solar applications, 9:49665 (R;US)
Materials
Advanced Research and Technology Development Fossil Energy Materials Program. Quarterly progress report ending June 30, 1984, 9:50094 (R;US)
Surveys
Survey of manufacturers of high-performance heat engines adaptable to solar applications, 9:49665 (R;US)
Thermal Efficiency
Survey of manufacturers of high-performance heat engines adaptable to solar applications, 9:49665 (R;US)
HEAT EXCHANGERS
See also DIRECT CONTACT HEAT EXCHANGERS
FLUIDIZED BED HEAT EXCHANGERS
Design
Heat exchanger for coal gasification process, 9:49364 (P;US)
Fouling
Monitoring technology trends with patent data: fouling of heat exchangers. A case study, 9:50061 (R;US)
Survey of gas-side fouling in industrial heat-transfer equipment. Final report, 9:50052 (R;US)
Materials
Advanced Research and Technology Development Fossil Energy Materials Program. Quarterly progress report ending June 30, 1984, 9:50094 (R;US)
Aluminum alloy performance in industrial air-cooled applications, 9:50156 (J;US)
HEAT PUMPS
See also AIR SOURCE HEAT PUMPS
SOLAR-ASSISTED HEAT PUMPS
Sorption
High temperature absorption heat pump, 9:49999 (R;CH;In German)
Thermal Energy Storage Equipment
Comparison of energy storage systems in the United States chilled water versus two types of ice storage systems, 9:49969 (R;US)
Working Fluids
High temperature absorption heat pump, 9:49999 (R;CH;In German)
HEAT RECOVERY EQUIPMENT
Fouling
Monitoring technology trends with patent data: fouling of heat exchangers. A case study, 9:50061 (R;US)
Materials
Advanced Research and Technology Development Fossil Energy Materials Program. Quarterly progress report ending June 30, 1984, 9:50094 (R;US)
HEAT STORAGE
See also LATENT HEAT STORAGE
SENSIBLE HEAT STORAGE
Aquifers
Study of storage capacity in a captive aquifer used as geothermal reservoir. Final report and summary report, 9:49909 (R;LU;In French)
Technology Assessment
Assessment of nonlatent heat storage technologies for industrial applications, 9:49906 (R;US)
HEAT STORAGE DEVICES
See THERMAL ENERGY STORAGE EQUIPMENT
HEAT STORAGE SYSTEMS
See THERMAL ENERGY STORAGE EQUIPMENT
HEAT TRANSFER
Mathematical Models
HTCC - a heat transfer model for gas-steam mixtures, 9:49846 (R;DE;In German)
Measuring Instruments
Convection heat transfer in the critical region of fluid mixtures. Progress report, 9:50399 (R;US)
Simulation
Efficient numerical methods for analysis of nuclear reactor thermohydraulics, 9:49799 (RA;BG;In Bulgarian)
Thermosyphons
Heat transfer in a closed thermosyphon tube filled with near critical fluid, 9:50404 (R;DE;In German)
HEAT TRANSFER FLUIDS
Performance
Improvement of the performance of solar energy or waste heat utilization systems by using phase-change slurry as an enhanced heat-transfer/storage fluid, 9:49710 (BA;US)
Phase Change Materials
Improvement of the performance of solar energy or waste heat utilization systems by using phase-change slurry as an enhanced heat-transfer/storage fluid, 9:49710 (BA;US)
HEAT TRANSMISSION
See HEAT TRANSFER
HEATING SYSTEMS
See also SOLAR HEATING SYSTEMS
Field Tests
High efficiency residential condensing gas forced air and high efficiency pulse boilers field evaluation - final report (project report No. 5B), 9:50012 (R;CA)
HEAVY FUELS
See RESIDUAL FUELS
HEAVY ION ACCELERATORS
Includes combined accelerator types for heavy ion acceleration.
Colliding Beams
10-GeV heavy-ion collider, 9:50443 (R;US)
Accelerator-colliders for relativistic heavy ions or in search of luminosity, 9:50444 (R;US)
Storage Rings
Accelerator-colliders for relativistic heavy ions or in search of luminosity, 9:50444 (R;US)
Superconducting Cavity Resonators
Status of rf superconductivity at Argonne National Laboratory, 9:50458 (R;US)
HEAVY ION REACTIONS
See also CARBON 12 REACTIONS
CARBON 13 REACTIONS
DEEP INELASTIC HEAVY ION REACTIONS

FLUORINE 19 REACTIONS
LITHIUM 7 REACTIONS
NITROGEN 14 REACTIONS
OXYGEN 16 REACTIONS
OXYGEN 17 REACTIONS
OXYGEN 18 REACTIONS
SULFUR 32 REACTIONS
Heavy-ion physics - the future, 9:50872 (RA;AU)
Fission
Heavy ion induced fission reactions, 9:50891 (RA;AU)
Neutron Emission
Neutron evaporation following heavy ion reactions for systems with 150 < A < 190, 9:50883 (RA;AU)
Particle Production
Near-threshold production of neutral π mesons in heavy-ion reactions, 9:50848 (R;US)
Quark Matter
Hydrodynamical description of the quark-gluon plasma formation in heavy-ion collisions at intermediate energies, 9:50913 (R;HU)
Scattering
Direct reaction analysis of heavy ion collision from the quasi-elastic to the deep-inelastic regime, 9:50857 (RA;AU)

HEAVY ION SPECTROMETERS
Cherenkov Counters
Cerenkov detector for heavy-ion velocity measurements, 9:50482 (R;US)

HEAVY LEPTONS
See also TAU NEUTRINOS
TAU PARTICLES
Particle Identification
Comparison of various observations of M*sub($\mu\pi$) (0.429), 9:50783 (RA;AU)

HEAVY OILS
See PETROLEUM

HEAVY WATER
Isotope Ratio
Program for TI programmable 59 calculator for calculation of ^3H concentration of water samples, 9:50351 (R;PK)

HEAVY WATER COOLANT
See HEAVY WATER

HEAVY WATER MODERATOR
See HEAVY WATER

HELIOSTATS
Solar Reflectors
Technical and cost potential for lightweight, stretched-membrane heliostat technology, 9:49709 (BA;US)

HELIUM
Purification
Fermilab satellite refrigerator compressors with oil and moisture removal systems, 9:50468 (BA;US)
Water Removal
Fermilab satellite refrigerator compressors with oil and moisture removal systems, 9:50468 (BA;US)

HELIUM 3
T Invariance
Superfluid ^3He. Neutral currents, T invariance, gravitation, 9:50755 (RA;SU;In Russian)
Uses
Superfluid ^3He. Neutral currents, T invariance, gravitation, 9:50755 (RA;SU;In Russian)
Weak Neutral Currents
Superfluid ^3He. Neutral currents, T invariance, gravitation, 9:50755 (RA;SU;In Russian)

HELIUM 3 TARGET
Photonuclear Reactions
Measurement of coherent π^0 photoproduction on ^3He and ^3H in the resonance region, 9:50828 (R;DE)

HELIUM 4 REACTIONS
See ALPHA REACTIONS

HELIUM DILUTION REFRIGERATORS
Gas Compressors
Fermilab satellite refrigerator compressors with oil and moisture removal systems, 9:50468 (BA;US)
Operation
Fermilab central helium liquefier operations, 9:50467 (BA;US)

HELIUM IONS
Collisions
New method for determination of interstitial profiles and sputtering coefficients, 9:50738 (RA;SU;In Russian)
Energy Losses
Angular dependence of helium ion energy losses in gold, 9:50931 (RA;SU;In Russian)

HEPATOMAS
Radioinduction
Plutonium-induced wounds in beagles, 9:50621 (J;GB)

HERBS
Radionuclide Kinetics
Absorption of ^{45}Ca during the immersion of the aerial organs of Salicornia stricta, 9:50603 (R;FR;FR)

HETEROJUNCTIONS
Prior to July 1981, this concept was indexed to SEMICONDUCTOR JUNCTIONS.
Production
Growth and properties of semiconductor strained-layer superlattices, 9:50186 (R;US)

HEXANE
Chemical Reactions
Reactions of $FeCH_3^+$ and $CoCH_3^+$ with aliphatic alkanes in the gas phase, 9:50322 (J;US)
Radiolysis
Picosecond pulse radiolysis studies to understand the primary processes in radiolysis, 9:50346 (R;US)

HFIR REACTOR
Targets
Transuranium Processing Plant report of production, status, and plans for October 1, 1980-March 31, 1983, 9:50350 (R;US)

HIGH ENERGY PHYSICS
Use only for articles of a very broad nature such as an annual research program, etc.
Laboratories
High energy physics facilities. Hearing before the Subcommittee on Energy Development and Applications of the Committee on Science and Technology, US House of Representatives, Ninety-Eighth Congress, First Session, October 19, 1983, 9:50761 (B;US)
Meetings
Elementary particle physics. Proceedings of 17. Winter school of Leningrad Institute of Nuclear Physics, 9:50760 (R;UA)
Research Programs
High energy physics facilities. Hearing before the Subcommittee on Energy Development and Applications of the Committee on Science and Technology, US House of Representatives, Ninety-Eighth Congress, First Session, October 19, 1983, 9:50761 (B;US)
Research in elementary particle physics. Progress report, August 1, 1979-July 31, 1984, 9:50759 (R;US)

HIGH EXPLOSIVES
See CHEMICAL EXPLOSIVES

HIGH FLUX ISOTOPE REACTOR
See HFIR REACTOR

HIGH TEMPERATURE GAS COOLED AND GRAPHITE
See HTGR TYPE REACTORS

HIGH-LEVEL RADIOACTIVE WASTES
Bibliographies
High-level radioactive wastes. Supplement 1, 9:49548 (R;US)
Materials Handling
Pump for metering high-level waste and glass former mixtures to an electric melter, 9:49555 (R;US)
Radioactive Waste Disposal
Performance assessment plans and methods for the Salt Repository Project, 9:49539 (R;US)
Perspective on demonstrations of compliance for high-level waste disposal, 9:49540 (R;US)
Radioactive Waste Processing
Processing of highly radioactive nuclear waste, 9:49563 (TJ;GB)
Waste Management Program. Technical progress report, July-September 1983, 9:49549 (R;US)

Vitrification
Nuclear waste glass composition limitations (Effects of reprocessing plant flowsheets on cost of vitrification), 9:49557 (R;US)

HIGHLY ENRICHED URANIUM
80 - 100 per cent.
Reactivity
Calculations of K with burn-up for various enrichments for MTR type core, 9:49842 (R;PK)

HOT CELLS
Neutron Radiography
Hot Fuel Examination Facility's neutron radiography reactor, 9:50366 (R;US)

HOT GAS CLEANUP
Capitalized Cost
Hot gas cleanup using porous ceramic cross flow filters, 9:49394 (RA;US)
Granular Bed Filters
High-temperature moving bed granular filter development at Combustion Power Company, 9:49390 (RA;US)
Testing and verification of granular bed filters for removal of particulates and alkalis, 9:49389 (RA;US)
Meetings
Contaminant control in hot coal derived gas streams: proceedings, 9:49388 (R;US)

HOT WATER HEATERS
See WATER HEATERS

HOT-DRY-ROCK SYSTEMS
Mineralogy
Mineralogical aspects of the production of geothermal energy, 9:49722 (TJ;US)
Resource Development
Mineralogical aspects of the production of geothermal energy, 9:49722 (TJ;US)

HOUSEHOLDS
Power Demand
Measuring the impact of residential conservation programs: a case study, 9:49984 (RA;US)

HOUSES
Energy Conservation
Can a simple physically-based model provide accurate scorekeeping of electricity savings in houses?, 9:49991 (RA;US)
Conserving energy in your home, 9:50008 (R;PR;In Spanish)
Responding to the conservation needs of low-income and multi-family residential customers, 9:49988 (RA;US)
Fuel Consumption
Main characteristics of low-cost housing aimed at reducing energy consumption for heating. Final report, 9:50018 (R;LU;In French)
Furnaces
Medium efficiency non-condensing furnace field study - installation report - report No. 9A, 9:50013 (R;CA)
Heating Systems
Main characteristics of low-cost housing aimed at reducing energy consumption for heating. Final report, 9:50018 (R;LU;In French)
Solar Space Heating
Living Systems. Monthly performance report, 9:49695 (R;US)
Solar Water Heating
Living Systems. Monthly performance report, 9:49695 (R;US)
Weatherization
Responding to the conservation needs of low-income and multi-family residential customers, 9:49988 (RA;US)

HTGR TYPE REACTORS
See also AVR REACTOR
Burnable Poisons
Technical papers presented at the thirteenth Dragon Countries physics meeting, 9:49779 (R;GB)
Fuel Management
Technical papers presented at the thirteenth Dragon Countries physics meeting, 9:49779 (R;GB)
Loss of Flow
Safety conception of the high temperature reactor with natural heat removal decay in the case of accidents, 9:49860 (R;DE;In German)
Meetings
Technical papers presented at the thirteenth Dragon Countries physics meeting, 9:49779 (R;GB)
Modular Structures
Special analyses of the temperature and fission product behaviour of HTR-MODUL plants, 9:49861 (R;DE;In German)
Packed Bed
Effective thermal conductivity in packed beds of spheres especially in the core of a high temperature reactor, 9:49780 (R;DE;In German)
Planning
Civilian uses of nuclear power: status and future, 9:49790 (RA;US)
Reactor Cores
Effective thermal conductivity in packed beds of spheres especially in the core of a high temperature reactor, 9:49780 (R;DE;In German)
Reactor Kinetics
Technical papers presented at the thirteenth Dragon Countries physics meeting, 9:49779 (R;GB)
Reactor Safety
Special analyses of the temperature and fission product behaviour of HTR-MODUL plants, 9:49861 (R;DE;In German)
Specifications
Civilian uses of nuclear power: status and future, 9:49790 (RA;US)

HTO
See HEAVY WATER
TRITIUM COMPOUNDS

HUGENHOLTZ-PINES THEORY
See HYDROGEN

HUMAN CELLS
See ANIMAL CELLS

HUMAN FACTORS
Data Base Management
Process evaluation of the human reliability data bank, 9:49937 (R;US)

HUMAN POPULATIONS
See also A-BOMB SURVIVORS
Radiation Doses
Exposure and risk calculations for disposal of wastes having minimal radioactivity, 9:49566 (R;US)
Incineration of hazardous and low-level radioactive waste by a small generator. Final report, 9:49564 (R;US)
Radionuclide Kinetics
Plutonium contamination in Italian population, 9:50611 (R;IT;In Italian)

HUMANS
See HUMAN POPULATIONS

HYDRAULIC FRACTURING
Feasibility Studies
Feasibility study: vertical fracturing in directionally drilled wells. Final report, January 1983-September 1983, 9:49482 (R;US)

HYDRAULIC RAMS
See PUMPS

HYDRAZINE
Carcinogenesis
Chemical and molecular biological aspects of alkylhydrazine-induced carcinogenesis in human cells in vitro. Revised. Final report 1 July 1980-30 September 1983, 9:50628 (R;US)

HYDROBROMIC ACID
Electrolysis
Simulated performance of the Texas Instruments Solar Energy System in various U.S. cities, 9:49655 (BA;US)

HYDROCARBONS
See also ANTHRACENE
BENZENE
POLYCYCLIC AROMATIC HYDROCARBONS
TOLUENE
TRIPHENYLENE
Adsorption
Structure determination of molecular adsorbates with dynamical LEED and HREELS, 9:50745 (R;US)

Radiolysis
Picosecond pulse radiolysis studies to understand the primary processes in radiolysis, 9:50346 (R;US)

HYDROCHLORIC ACID
Absorption
Development of a hot gas cleanup system for integrated coal gasification/molten carbonate fuel cell power plants, 9:49341 (RA;US)
H_2S removal using mixed metal oxides and HCl removal using molten alkali carbonates, 9:49342 (RA;US)
Hot-gas chloride cleanup for molten carbonate fuel cells, 9:49339 (RA;US)
Chemical Reaction Kinetics
Development of a hot gas cleanup system for integrated coal gasification/molten carbonate fuel cell power plants, 9:49341 (RA;US)
Removal
Development of a hot gas cleanup system for integrated coal gasification/molten carbonate fuel cell power plants, 9:49341 (RA;US)

HYDROCYCLONES
See CYCLONE SEPARATORS

HYDROELECTRIC POWER
Financial Incentives
Post-war energy economics: the urban and regional implications, 9:49921 (RA;US)
Resource Potential
Water resources appraisal for hydroelectric licensing: Middle San Joaquin Valley basin, Fresno, Madera, Mariposa, and Merced Counties, California, 9:49593 (R;US)
Water resources appraisal for hydroelectric licensing: Middle San Joaquin Valley basin, Fresno, Madera, Mariposa, and Merced Counties, California, 9:49594 (R;US)

HYDROELECTRIC POWER PLANTS
See also LOW-HEAD HYDROELECTRIC POWER PLANTS
SMALL-SCALE HYDROELECTRIC POWER PLANTS
Commercialization
Information on relicensing cases at the Federal Energy Regulatory Commission, 9:49597 (R;US)
Cost Benefit Analysis
Information on relicensing cases at the Federal Energy Regulatory Commission, 9:49597 (R;US)
Licensing
Information on relicensing cases at the Federal Energy Regulatory Commission, 9:49597 (R;US)
Mapping
Glacial-hydrological conditions in Nordbosoe basin, Johan Dahl Land (Greenland), 9:49596 (R;DK;In Danish)
Surcharges
Allocation and apportionment of joint-use cost to power: a report on the assessment of headwater benefits charges, 9:49599 (R;US)

HYDROELECTRICITY
See HYDROELECTRIC POWER

HYDROGEN
Adsorption
^{57}Fe Moessbauer effect in $ThFe_3$ hydride, 9:50751 (J;US)
Embedded-atom method: Derivation and application to impurities, surfaces, and other defects in metals, 9:50143 (J;US)
Isothermal equilibrium pressures of a Y-Nb alloy-H_2 system, 9:50310 (J;CH)
Combustion
EPRI research on hydrogen combustion and control, 9:49866 (RA;DE)
Diffusion
Diffusion of deuterium and hydrogen in rutile TiO_2 crystals at low temperatures, 9:50208 (J;US)
Embedded-atom method: Derivation and application to impurities, surfaces, and other defects in metals, 9:50143 (J;US)
Electron-Atom Collisions
Extension of the multiconfiguration Hartree-Fock program for continuum functions, 9:50729 (R;US)
Metallurgical Effects
Advanced Research and Technology Development Fossil Energy Materials Program. Quarterly progress report ending June 30, 1984, 9:50094 (R;US)
Partial Pressure
Impact of hydrogen partial pressure on coal liquefaction. Final technical report, 9:49346 (R;US)
Reactor Safety
Light water reactor hydrogen safety research in the United States, 9:49865 (RA;DE)
Wave Functions
Extension of the multiconfiguration Hartree-Fock program for continuum functions, 9:50729 (R;US)

HYDROGEN 1 MINUS BEAMS
Ion Sources
Development of a high current H^- injector for the proton storage ring at LAMPF, 9:50463 (R;US)

HYDROGEN 2
See DEUTERIUM

HYDROGEN 3
See TRITIUM

HYDROGEN BROMIDES
See HYDROBROMIC ACID

HYDROGEN CHLORIDES
See HYDROCHLORIC ACID

HYDROGEN HYDROXIDES
See WATER

HYDROGEN IONS
See also HYDROGEN IONS 1 PLUS
Desorption
Electron-stimulated desorption from partially fluorinated hydrocarbon thin films: Molecules with common versus separate hydrogen and fluorine bonding sites, 9:50210 (J;US)

HYDROGEN IONS 1 PLUS
For H_1^+ ions.
Collisions
Punch-through of atomic planes at a shallow incidence angle of proton beam, 9:50739 (RA;SU;In Russian)

HYDROGEN ISOTOPES
See also DEUTERIUM
TRITIUM
Mass Spectroscopy
Advanced mass spectrometers for hydrogen isotope analyses, 9:50496 (R;US)

HYDROGEN MINUS 1 BEAMS
See HYDROGEN 1 MINUS BEAMS

HYDROGEN PEROXIDE
Chemical Reaction Yield
Studies of the aqueous chemistry of fluorine and hypofluorous acid, 9:50306 (J;US)
Ecological Concentration
Attempted measurement of gaseous H_2O_2 in the ambient atmosphere, 9:50520 (R;US)
Measuring Methods
Attempted measurement of gaseous H_2O_2 in the ambient atmosphere, 9:50520 (R;US)

HYDROGEN PHOSPHATES
See PHOSPHORIC ACID

HYDROGEN PRODUCTION
Hydrogen production from low-rank coals, 9:49332 (RA;US)
Biophotolysis
Method for producing hydrogen and oxygen by use of algae, 9:49576 (P;US)
Electrolysis
Water electrolysis using hybrid cyclic processes, 9:49574 (R;DE;In German)
Hybrid Systems
Water electrolysis using hybrid cyclic processes, 9:49574 (R;DE;In German)
Photoelectrolysis
Photovoltaic-electrolyzer system transient simulation results, 9:49656 (BA;US)
Research Programs
Photovoltaic-electrolyzer system transient simulation results, 9:49656 (BA;US)
Thermochemical Processes
Water electrolysis using hybrid cyclic processes, 9:49574 (R;DE;In German)

HYDROGEN SULFIDES
Absorption
Development of a hot gas cleanup system for integrated coal gasification/molten carbonate fuel cell power plants, 9:49341 (RA;US)
Equilibrium measurements for the absorption of H_2S, COS and HCl by alkali metal carbonates, 9:49368 (J;US)
H_2S removal using mixed metal oxides and HCl removal using molten alkali carbonates, 9:49342 (RA;US)
Zinc ferrite hydrogen sulfide absorbent, 9:49340 (RA;US)
Chemical Reaction Kinetics
Development of a hot gas cleanup system for integrated coal gasification/molten carbonate fuel cell power plants, 9:49341 (RA;US)
Phase Studies
Sour water stripping of coal gasification waste water. Final report, 9:49386 (R;US)
Removal
Development of a hot gas cleanup system for integrated coal gasification/molten carbonate fuel cell power plants, 9:49341 (RA;US)
Metal/metal oxides as high temperature desulfurization sorbents, 9:49338 (RA;US)
Sour water stripping of coal gasification waste water. Final report, 9:49386 (R;US)
HYDROGENATION
Catalysts
New and improved dispersion and recovery techniques for slurry phase catalysis. Quarterly report, January-March, 1984, 9:49355 (R;US)
Studies relevant to the catalytic activation of carbon monoxide: the water gas shift reaction and related processes. Technical progress report, December 1, 1983-November 30, 1984, 9:49330 (R;US)
Mathematical Models
New and improved dispersion and recovery techniques for slurry phase catalysis. Quarterly report, January-March, 1984, 9:49355 (R;US)
HYDROLOGY
Institute of Radiohydrometry annual report 1981, 9:50656 (R;DE;In German)
HYDROTHERMAL CONVECTIVE SYSTEMS
See HYDROTHERMAL SYSTEMS
HYDROTHERMAL SYSTEMS
Protective Coatings
Hydrothermal durability of Ca-complexed methylmethacrylate-trimethylolpropane trimethacrylate copolymer films and coatings containing superficially formed CaO-SiO_2-H_2O type inorganic macromolecules, 9:50172 (R;US)
HYDROXYBENZENE
See PHENOL
HYDROXYBENZOIC ACID-ORTHO
See SALICYLIC ACID
HYDROXYL RADICALS
Detection
Shot noise limited detection of OH using the technique of laser induced fluorescence, 9:50513 (R;US)
Fluorescence
Comments on laser-excited fluorescence of the hydroxyl radical: relaxation coefficients at atmospheric pressure, appendix 5, 9:50748 (R;US)
Shot noise limited detection of OH using the technique of laser induced fluorescence, 9:50513 (R;US)
HYPOFLUOROUS ACID
Chemical Reaction Kinetics
Studies of the aqueous chemistry of fluorine and hypofluorous acid, 9:50306 (J;US)
HYPOPHYSIS
See PITUITARY GLAND

I

IAEA SAFEGUARDS
Security Seals
Joint US-German evaluation of electronic safeguards seal systems, 9:49570 (R;DE)
ICE
Freezing
Hybrid system for producing and storing ice, 9:49683 (R;US)
Underground Storage
Hybrid system for producing and storing ice, 9:49683 (R;US)
ICF DEVICES
First Wall
Wet wall cavity response in ICF reactors, 9:51032 (R;US)
ICR HEATING
Current drive by ICRF heating of alpha-particles and beam ions, 9:50984 (RA;GB)
Minority ICRF current drive in toroidal geometry, 9:50983 (RA;GB)
Ion Beam Injection
ICRF enhancement of beam-driven currents, 9:50985 (RA;GB)
IEA
See INTERNATIONAL ENERGY AGENCY
IGNITION
Raman Spectroscopy
Ignition probing by laser techniques. Preliminary experiments, 9:50077 (R;SE)
IGT WASTE PROCESS
See BIOGAS PROCESS
ILLINOIS
Radioactive Waste Facilities
Directions in low-level radioactive waste management. Low-level radioactive waste disposal: commercial facilities no longer operating, 9:49544 (R;US)
Renewable Energy Sources
Current alternative energy research and development in Illinois, 9:49959 (R;US)
ILLUMINATION SYSTEMS
See LIGHTING SYSTEMS
IMINES
For aldehyde and ketone derivatives only.
See also SCHIFF BASES
Radiosensitivity Effects
Effects of cellular non-protein sulfhydryl depletion in radiation induced oncogenic transformation and genotoxicity in mouse C_3H 10T1/2 cells, 9:50616 (J;US)
IMMOBILIZATION
See VITRIFICATION
IMPERMEABLE DRY ROCK
See HOT-DRY-ROCK SYSTEMS
INCINERATORS
Design
Design and operational experience with the off-gas cleaning system of the Seibersdorf incinerator plant, 9:49552 (R;AT)
Environmental Impacts
Incineration of hazardous and low-level radioactive waste by a small generator. Final report, 9:49564 (R;US)
Heat Recovery
Evaluating applications of heat recovery incinerators: information and approaches, 9:50062 (R;US)
Licensing
Incineration of hazardous and low-level radioactive waste by a small generator. Final report, 9:49564 (R;US)
Operation
Design and operational experience with the off-gas cleaning system of the Seibersdorf incinerator plant, 9:49552 (R;AT)
Risk Assessment
Inhalation pathway risk assessment of hazardous waste incineration facilities, 9:50636 (R;US)
INCOMPRESSIBLE FLOW
Magnetohydrodynamics
Planar incompressible Yang-Mills magnetohydrodynamics, 9:50757 (J;IT)

Mathematical Models
Three-dimensional vortex methods, 9:50756 (R;US)
Vortex Flow
Three-dimensional vortex methods, 9:50756 (R;US)
INCONEL 713LC
Corrosion
Static and dynamic strength of gas turbine blade material under conditions of high temperature corrosion, 9:50136 (R;DE;In German)
Creep
Static and dynamic strength of gas turbine blade material under conditions of high temperature corrosion, 9:50136 (R;DE;In German)
Fatigue
Static and dynamic strength of gas turbine blade material under conditions of high temperature corrosion, 9:50136 (R;DE;In German)
Tensile Properties
Static and dynamic strength of gas turbine blade material under conditions of high temperature corrosion, 9:50136 (R;DE;In German)
INCONEL 718
Impurities
NMR study of hydrogen in cathodically charged inconel 718, 9:50113 (RA;IL)
NMR Spectra
NMR study of hydrogen in cathodically charged inconel 718, 9:50113 (RA;IL)
INCONEL 738
Corrosion
Static and dynamic strength of gas turbine blade material under conditions of high temperature corrosion, 9:50136 (R;DE;In German)
Creep
Static and dynamic strength of gas turbine blade material under conditions of high temperature corrosion, 9:50136 (R;DE;In German)
Fatigue
Static and dynamic strength of gas turbine blade material under conditions of high temperature corrosion, 9:50136 (R;DE;In German)
Tensile Properties
Static and dynamic strength of gas turbine blade material under conditions of high temperature corrosion, 9:50136 (R;DE;In German)
INDIUM ARSENIDES
Growth and properties of semiconductor strained-layer superlattices, 9:50186 (R;US)
INDIUM PHOSPHIDES
Annealing
Laser-induced surface defects, 9:50252 (BA;NL)
Physical Radiation Effects
Laser-induced surface defects, 9:50252 (BA;NL)
INDIUM SELENIDES
Carrier Density
Electronic properties versus composition of thin films of $CuInSe_2$, 9:49629 (J;US)
Chemical Composition
Electronic properties versus composition of thin films of $CuInSe_2$, 9:49629 (J;US)
Electrical Properties
Electronic properties versus composition of thin films of $CuInSe_2$, 9:49629 (J;US)
Electrochemistry
n-$CuInSe_2$ based photoelectrochemical cells: Improved, stable performance in aqueous polyiodide through rational surface and solution modifications, 9:49628 (J;US)
Etching
n-$CuInSe_2$ based photoelectrochemical cells: Improved, stable performance in aqueous polyiodide through rational surface and solution modifications, 9:49628 (J;US)
Oxidation
n-$CuInSe_2$ based photoelectrochemical cells: Improved, stable performance in aqueous polyiodide through rational surface and solution modifications, 9:49628 (J;US)
Photochemistry
n-$CuInSe_2$ based photoelectrochemical cells: Improved, stable performance in aqueous polyiodide through rational surface and solution modifications, 9:49628 (J;US)
Stoichiometry
Electronic properties versus composition of thin films of $CuInSe_2$, 9:49629 (J;US)
INDOOR AIR POLLUTION
Reviews
Review of recent research in indoor air quality. Final report October 1983-February 1984, 9:50533 (R;US)
INDUCED RADIOACTIVITY
See RADIOACTIVITY
INDUSTRIAL MEDICINE
Atomic Energy Laws
Medical inspection according to the new nuclear power law, 9:49930 (RA;NL;In Dutch)
Radiation Protection
Industrial doctor and radiation hygiene at ECN, 9:50937 (RA;NL;In Dutch)
INDUSTRIAL PLANTS
See also COAL GASIFICATION PLANTS
COAL LIQUEFACTION PLANTS
COAL PREPARATION PLANTS
ETHANOL PLANTS
FEED MATERIALS PLANTS
ISOTOPE SEPARATION PLANTS
METHANOL PLANTS
OIL SHALE PROCESSING PLANTS
Energy Audits
Effectiveness assessment visits. Energy Analysis and Diagnostic Centers, October-November 1981, 9:49974 (R;US)
Energy management assistance for small and medium-size manufacturers. A third-stage evaluation of the 1981-1983 EADC program, 9:49972 (R;US)
Energy management assistance for small and medium-size manufacturers. A first-stage evaluation of the 1983-1984 EADC program, 9:49970 (R;US)
Energy management assistance for small and medium-size manufacturers. A first-stage evaluation of the 1981-1983 program, 9:49975 (R;US)
Energy management assistance for small and medium-size manufacturers. An evaluation of the EADC program, 9:49979 (R;US)
Implementation results and financial returns from EADCS' recommendations to conserve energy and control costs. Third phase, 1981-1983 program, 9:49971 (R;US)
Implementation results and financial returns from EADCs' recommendations to conserve energy and control costs. Second phase, 1981-1983 program, 9:49973 (R;US)
Implementation of EADCs' recommendations to conserve energy and save dollars (1981-1982), 9:49978 (R;US)
Implementation of energy conservation opportunities by small and medium-size manufacturers. Second phase, 1981-1983 EADC program, 9:49976 (R;US)
Program of direct energy conservation assistance for medium-size and small manufacturers. Energy Analysis and Diagnostic Centers, September 1981-September 1982, 9:49977 (R;US)
Energy Conservation
Determinants of interest in new energy reduction projects among commercial and industrial ratepayers, 9:49993 (RA;US)
Impact and cost-effectiveness of utility conservation programs: the Hartford Foundation project, 9:49992 (RA;US)
Energy Consumption
Program of direct energy efficiency improvement for medium-size and small manufacturers. Energy Analysis and Diagnostic Centers phase three of the 1981 to 1983 program , 9:50035 (R;US)
Heat Exchangers
Survey of gas-side fouling in industrial heat-transfer equipment. Final report, 9:50052 (R;US)
Heat Storage
Assessment of nonlatent heat storage technologies for industrial applications, 9:49906 (R;US)

INDUSTRIAL RADIOGRAPHY
See also BIOMEDICAL RADIOGRAPHY.
Portable Sources
Portable radiography using linear accelerators, 9:49572 (R;US)
X-Ray Sources
Portable radiography using linear accelerators, 9:49572 (R;US)
INDUSTRIAL SECTOR
See INDUSTRY
INDUSTRY
See also AUTOMOTIVE INDUSTRY
COAL INDUSTRY
ELECTRIC POWER INDUSTRY
GEOTHERMAL INDUSTRY
GLASS INDUSTRY
NATURAL GAS INDUSTRY
NUCLEAR INDUSTRY
OIL SHALE INDUSTRY
PETROLEUM INDUSTRY
SOLAR INDUSTRY
SYNTHETIC FUELS INDUSTRY
Energy Audits
EnergyCHECK commercial/industrial energy audit program, 9:50049 (RA;US)
Program of direct energy efficiency improvement for medium-size and small manufacturers. Energy Analysis and Diagnostic Centers phase three of the 1981 to 1983 program , 9:50035 (R;US)
Energy Expenses
Appendices A, B, and C of the methodology for life cycle cost analysis using average fuel costs, 9:49955 (R;US)
Heat Recovery Equipment
Survey of flue gas condensation heat recovery systems. Final report February-October 1981, 9:50060 (R;US)
Maintenance
Experts' meeting: Maintenance '83. Maintenance and reliability, 9:50368 (R;DE;In German)
Reliability
Experts' meeting: Maintenance '83. Maintenance and reliability, 9:50368 (R;DE;In German)
INERTIAL CONFINEMENT FUSION DEVICES
See ICF DEVICES
INFORMATION CENTERS
Construction
Specification for Information Center, Solar One Generating Station. Addendum No. 1, 9:49668 (R;US)
Specifications
Specification for Information Center, Solar One Generating Station. Addendum No. 1, 9:49668 (R;US)
INFORMATION SYSTEMS
Computer Networks
Integration of an automated library support system with an intelligent gateway, 9:51063 (R;US)
INHALATION EXPOSURE CHAMBERS
See EXPOSURE CHAMBERS
INJECTION (BEAMS)
See BEAM INJECTION
INNER-SHELL IONIZATION
Cross Sections
L subshell X-ray production by 100 to 250 keV/a.m.u. ions, 9:50734 (RA;AU)
New look at the L subshell Coulomb deflection factors for inner shell ionisation, 9:50733 (RA;AU)
Perturbation Theory
Ion induced x-ray emission, 9:50732 (RA;AU)
IN-SITU GASIFICATION
Bench-Scale Experiments
Alternating-pressure underground gasification, 9:49367 (TG;US)
Planning
Centralia double module in situ coal gasification test conceptual design, 9:49362 (R;US)
INSOLATION
Data Compilation
Weather data for simplified energy calculation methods. Volume IV. United States: WYEC data, 9:50022 (R;US)
Weather data for simplified energy calculation methods. Volume II. Middle United States: TRY data, 9:50020 (R;US)
Weather data for simplified energy calculation methods. Volume I. Eastern United States: TRY data, 9:50019 (R;US)
Weather data for simplified energy calculation methods. Volume III. Western United States: TRY data, 9:50021 (R;US)
INSULATING LIMITERS
See LIMITERS
INSULATORS (ELECTRICAL)
See ELECTRICAL INSULATORS
INTAKE STRUCTURES
Field Tests
Advanced intake technologies study. Final report, 9:49745 (R;US)
INTEGRALS
Finite Element Method
Treatment of material laws for approximate J-estimation methods, 9:50111 (R;DE)
INTEGRATED UTILITY SYSTEMS
See TOTAL ENERGY SYSTEMS
INTERCONNECTED POWER SYSTEMS
Control
Methodology for power system emergency state control, 9:49743 (R;US)
INTERMEDIATE MASS NUCLEI
For nuclei with mass 41-180.
See also BARIUM 130
BARIUM 132
BARIUM 134
BARIUM 136
BARIUM 138
CALCIUM 44
CALCIUM 45
CALCIUM 48
CHLORINE 41
COBALT 60
IODINE 125
IODINE 131
KRYPTON 75
KRYPTON 77
KRYPTON 85
MANGANESE 56
STRONTIUM 90
TUNGSTEN 168
TUNGSTEN 178
Collective Excitations
Collective states in transitional nuclei, 9:50871 (RA;BG)
Energy Levels
Collective states in transitional nuclei, 9:50871 (RA;BG)
INTERMEDIATE VECTOR BOSONS
Leptonic Decay
Limits on tau composite structure from polarized Z^0 decay, 9:50788 (J;US)
INTERMETALLIC COMPOUNDS
Advanced Research and Technology Development Fossil Energy Materials Program. Quarterly progress report ending June 30, 1984, 9:50094 (R;US)
INTERNAL COMBUSTION ENGINES
See also DIESEL ENGINES
GAS TURBINE ENGINES
SPARK IGNITION ENGINES
Afterburners
Theoretical and experimental studies on the limits of capacity of the thermal reactor in after-treatment of exhaust gases, 9:50087 (R;DE;In German)
Air Pollution Control
Theoretical and experimental studies on the limits of capacity of the thermal reactor in after-treatment of exhaust gases, 9:50087 (R;DE;In German)
Carburetors
New knowledge in carburetor construction, 9:50072 (RA;DD;In German)
Fuel Consumption
Some connections between the efficiency degree of combustion engines and the fuel consumption of the vehicle, 9:50075 (RA;DD;In German)
Thermal Efficiency
Some connections between the efficiency degree of combustion engines and the fuel consumption of the vehicle, 9:50075 (RA;DD;In German)
INTERNAL CONTAMINATION
See RADIONUCLIDE KINETICS
INTERNAL MEDICINE
See MEDICINE

INTERNATIONAL ENERGY AGENCY
Oil supply disruptions and the role of the International Energy Agency, 9:49459 (R;US)
INTERNATIONAL NUCLEAR DATA COMMITTEE
Meetings
NEANDC specialists meeting on yields and decay data of fission product nuclides, 9:50819 (R;US)
INTERNATIONAL TOKAMAK REACTOR
See INTOR TOKAMAK
INTOR TOKAMAK
International Tokamak Reactor.
Magnet Coils
INTOR phase IIA, magnet system design - European contribution, 9:51034 (R;DE)
INTRANUCLEAR CASCADES
See NUCLEAR CASCADES
IODINE
Activation Analysis
Neutron activation analysis on a series of human gallstones, 9:50272 (RA;AU)
IODINE 125
Radiochemistry
Radiohalogen-labeled imaging agents. 3. Compounds for measurement of brain blood flow by emission tomography, 9:50595 (J;US)
Uptake
Retention of incorporated radionuclides after variable application of gamma-rays, 9:50614 (R;DE;In German)
IODINE 131
Environmental Exposure Pathway
Studies on the 'air-grass-cow-milk' exposure pathway of airborne ^{131}I from Wuergassen nuclear power plant in the 1980 grazing season, 9:50560 (R;DE;In German)
IODINE IODIDES
See IODINE
ION BEAMS
See also HYDROGEN 1 MINUS BEAMS
RBE
Hypoxic cell sensitizers and heavy charged particle beams may play complementary roles in killing hypoxic tumor cells, 9:50618 (J;US)
Uses
Fundamental aspects on ion-beam surface modification: defect production and migration processes, 9:50105 (R;US)
ION BLOCKING
See ION CHANNELING
ION CHANNELING
Interactions of MeV energy ion beams with solids, 9:50189 (RA;AU)
ION CYCLOTRON-RESONANCE HEATING
See ICR HEATING
ION IMPLANTATION
Fundamental aspects on ion-beam surface modification: defect production and migration processes, 9:50105 (R;US)
Recrystallization
Amorphous materials and recrystallization, 9:50420 (R;US)
ION MICROPROBE ANALYSIS
Interactions of MeV energy ion beams with solids, 9:50189 (RA;AU)
Alpha Beams
Application of an alpha particle microbeam to tissue analysis in medicine, 9:50276 (RA;AU)
Ion Channeling
Channeling contrast microscopy: application to large grain polycrystalline silicon, 9:50283 (RA;AU)
ION SCATTERING ANALYSIS
Interactions of MeV energy ion beams with solids, 9:50189 (RA;AU)
Beam Monitoring
Internal monitor in Rutherford scattering, 9:50737 (RA;SU;In Russian)
Spectra Unfolding
Analysis of multicomponent targets using H^+ and He^+ fast ion backscattering, 9:50741 (RA;SU;In Russian)
Unfolding of concentration profiles from backscattering energy spectra with allowance for some distortion factors, 9:50742 (RA;SU;In Russian)
ION-ATOM COLLISIONS
Inner-Shell Ionization
Ion induced x-ray emission, 9:50732 (RA;AU)
L subshell X-ray production by 100 to 250 keV/a.m.u. ions, 9:50734 (RA;AU)
New look at the L subshell Coulomb deflection factors for inner shell ionisation, 9:50733 (RA;AU)
Secondary Emission
Forward electron production in heavy ion-atom and ion-solid collisions, 9:50723 (R;US)
IONIC REACTIONS
See IONS
IONIZATION CALORIMETERS
See SHOWER COUNTERS
IONIZATION LOSS
See ENERGY LOSSES
IONIZING RADIATIONS
See also COSMIC RADIATION
GAMMA RADIATION
Carcinogenesis
Report on NCI symposium: comparison of mechanisms of carcinogenesis by radiation and chemical agents. II. Cellular and animal models, 9:50606 (R;US)
Electron Dosimetry
Austrian primary standard for ionizing radiation dosimetry. Results of international intercomparisons, 9:50940 (R;AT)
Gamma Dosimetry
Austrian primary standard for ionizing radiation dosimetry. Results of international intercomparisons, 9:50940 (R;AT)
Proton Dosimetry
Austrian primary standard for ionizing radiation dosimetry. Results of international intercomparisons, 9:50940 (R;AT)
IONS
Ions in solutions are indexed as compounds; ions in gases by the precoordinated descriptor consisting of the element name and the term ions; ions in beams by assigning either the specific name if available, e.g. ARGON 40 BEAMS
See also FLUORINE IONS
HELIUM IONS
HYDROGEN IONS
NICKEL IONS
OXYGEN IONS
Collisions
Influence of microturbulence on early time HANE structure. Memorandum report, 9:50818 (R;US)
Emission Spectroscopy
Topics in high resolution spectroscopy of stored ions, 9:50728 (R;US)
IRIDIUM ISOTOPES
High Spin States
Bose-fermi U(6/2j+1) supersymmetries and high spin anomalies, 9:50903 (R;AU)
Interacting Boson Model
Bose-fermi U(6/2j+1) supersymmetries and high spin anomalies, 9:50903 (R;AU)
IRON
Absorption Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Activation Analysis
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Corrosion
Evaluation of the three-point method to measure corrosion rates, 9:49730 (J;US)
Electronic Structure
Interface magnetism in metals: Ag/Fe(001), 9:50142 (J;US)
Emission Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Ferromagnetism
Ferromagnetism in metals at finite temperatures, 9:50945 (R;US)
Magnetic Properties
Interface magnetism in metals: Ag/Fe(001), 9:50142 (J;US)
Moessbauer Effect
^{57}Fe Moessbauer effect in $ThFe_3$ hydride, 9:50751 (J;US)

Neutron Transport
Theoretical and experimental investigation on neutron transport in moderating and shielding materials, 9:50930 (RA;BG;In Bulgarian)
Proton Microprobe Analysis
Elemental microanalysis of individual blood cells, 9:50277 (RA;AU)
Soil Chemistry
Attenuation of chemical elements in acidic leachates from coal mineral wastes by soils, 9:49407 (R;US)
X-Ray Fluorescence Analysis
On-stream determination of Zn-content in Zn-ore slurries by radioisotope excited X-ray fluorescence, 9:50291 (R;AT)

IRON ALLOYS
See also IRON BASE ALLOYS
Fabrication
Design of ordered intermetallic alloys for high-temperature structural use (Ni_3V-CO_3V-Fe_3V; Ni_3Al), 9:50096 (R;US)
Grain Boundaries
Atomistic studies of grain boundaries with segregated impurities. Final progress report, July 1983-June 30, 1984, 9:50108 (R;US)
Mechanical Properties
Design of ordered intermetallic alloys for high-temperature structural use (Ni_3V-CO_3V-Fe_3V; Ni_3Al), 9:50096 (R;US)
Neutron Diffraction
Neutron diffraction study of the tetragonal $NpCu_4Al_8$ and $ErFe_4Al_8$ intermetallic compounds, 9:50114 (RA;IL)

IRON BASE ALLOYS
See also CAST IRON
STEELS
Mechanical Properties
Alloying effects and microstructure of iron aluminides, 9:50097 (R;US)
Microstructure
Alloying effects and microstructure of iron aluminides, 9:50097 (R;US)
Neutron Diffraction
Neutron diffraction experiments on amorphous alloys, 9:50131 (R;HU)
Oxidation
Oxidation-sulfidation behavior of materials in coal-conversion environments, 9:50152 (J;JP)
Physical Radiation Effects
Experimental determination of the critical cavity radius in Fe-10% Cr for ion irradiation, 9:50098 (R;US)
Sulfidation
Oxidation-sulfidation behavior of materials in coal-conversion environments, 9:50152 (J;JP)

IRON CHLORIDES
Magnetic Properties
Observation of a disordered spin-flop phase in Fe/sub 0.725/Co/sub 0.275/Cl_3, 9:50308 (J;US)
Phase Diagrams
Observation of a disordered spin-flop phase in Fe/sub 0.725/Co/sub 0.275/Cl_3, 9:50308 (J;US)

IRON COMPLEXES
Chemical Reactions
Reactions of $FeCH_3^+$ and $CoCH_3^+$ with aliphatic alkanes in the gas phase, 9:50322 (J;US)
Reactions of $FeCH_3^+$ and $CoCH_3^+$ with cyclic hydrocarbons in the gas phase, 9:50323 (J;US)
Structural Chemical Analysis
Reactions of $FeCH_3^+$ and $CoCH_3^+$ with aliphatic alkanes in the gas phase, 9:50322 (J;US)
Reactions of $FeCH_3^+$ and $CoCH_3^+$ with cyclic hydrocarbons in the gas phase, 9:50323 (J;US)

IRON COMPOUNDS
See also IRON CHLORIDES
Catalytic Effects
Studies relevant to the catalytic activation of carbon monoxide: the water gas shift reaction and related processes. Technical progress report, December 1, 1983-November 30, 1984, 9:49330 (R;US)
Decomposition
^{57}Fe Moessbauer effect in $ThFe_3$ hydride, 9:50751 (J;US)
Sorptive Properties
^{57}Fe Moessbauer effect in $ThFe_3$ hydride, 9:50751 (J;US)

IRON-NICKEL BATTERIES
Electric Conductivity
Contribution to the description of the electrical behaviour of lead, nickel-cadmium, and nickel-iron accumulators, 9:49914 (R;DE;In German)

IRT-SOFIA REACTOR
Background Radiation
Determination of the natural gamma background by means of TLD. Some results of the environmental monitoring around the IRT-2000 reactor in Sofia, 9:49831 (RA;BG;In Bulgarian)
Coolants
Non-sampling gamma-spectrometric analysis of IRT-2000 reactor coolant, 9:49826 (RA;BG;In Bulgarian)
Radiation Monitoring
Determination of the natural gamma background by means of TLD. Some results of the environmental monitoring around the IRT-2000 reactor in Sofia, 9:49831 (RA;BG;In Bulgarian)
Quantitative characteristics of the radiation background components in the Vitosha Mountain area and around nuclear reactor IRT-2000, Sofia, 9:49829 (RA;BG;In Bulgarian)
Results and conclusions from the radiation monitoring around the IRT-2000 nuclear reactor in Sofia for the 1962-1982 period, 9:49828 (RA;BG;In Bulgarian)
Results and quantitative evaluations of the radionuclides and the level of the radiation background in Vitosha Mountain area and around the nuclear reactor IRT-2000, Sofia, 9:49830 (RA;BG;In Bulgarian)

ISLAMABAD REACTOR PAKISTAN
See PARR REACTOR

ISOBUTANE
See 2-METHYLPROPANE

ISOBUTYL RADICALS
Formation Heat
Photoelectron spectroscopy of 1-propyl, 1-butyl, isobutyl, neopentyl, and 2-butyl radicals: free radical precursors to high-energy carbonium ion isomers (Studied at elevated temperature to increase extent of radical decomposition), 9:50357 (J;US)
Ionization Potential
Photoelectron spectroscopy of 1-propyl, 1-butyl, isobutyl, neopentyl, and 2-butyl radicals: free radical precursors to high-energy carbonium ion isomers (Studied at elevated temperature to increase extent of radical decomposition), 9:50357 (J;US)

ISOMERS
Only for geometrical isomers and stereoisomers in chemistry; see also ISOMERIC NUCLEI and FISSION ISOMERS.
P Invariance
Parity nonconservation effects in stereoisomers, 9:50735 (RA;SU;In Russian)

ISOPENTANE
See 2-METHYLBUTANE

ISOTOPE SEPARATION PLANTS
See also CENTRIFUGE ENRICHMENT PLANTS
Operation
Investigations into the operating behavior of separation nozzle cascades for uranium-235 enrichment in a 10-stage pilot plant, 9:49510 (R;DE;In German)

ISX TOKAMAK
Limiters
Design and fabrication of a beryllium limiter for ISX-B, 9:51027 (R;US)
Plasma Diagnostics
Far-infrared laser diagnostic on EBT and extreme far-forward laser scattering on ISX, 9:51002 (R;US)

IUS
See TOTAL ENERGY SYSTEMS

J

JAILS
See PUBLIC BUILDINGS
JAPAN
Energy Conservation
Assessment of technical strengths and information flow of energy conservation research in Japan. Volume 1. Executive summary, 9:49943 (R;US)
Research Programs
Assessment of technical strengths and information flow of energy conservation research in Japan. Volume 1. Executive summary, 9:49943 (R;US)
JENSEN SARCOMA
See EXPERIMENTAL NEOPLASMS
JET ENGINE FUELS
Prices
State Energy Price System: 1982 update, 9:49952 (R;US)
Sales
Petroleum marketing monthly, July 1984, 9:49455 (R;US)
JET MODEL
Limiting Fragmentation
Merging of jets, 9:50778 (R;DE)
JFT-2 TOKAMAK
Current-Drive Heating
Study of the current drive by the lower hybrid wave in a tokamak, 9:50996 (RA;GB)
High-Frequency Heating
Study of the current drive by the lower hybrid wave in a tokamak, 9:50996 (RA;GB)
JOSEPHSON JUNCTIONS
Disturbances
Resonant activation of a Josephson junction, 9:50372 (R;US)
Microwave Radiation
Resonant activation of a Josephson junction, 9:50372 (R;US)
Noise
Chaos and related nonlinear noise phenomena in Josephson tunnel junctions, 9:50955 (R;US)
Solitons
Coupled nonlinear oscillators, 9:50387 (B;NL)
JT-60 REACTORS
Cooling Systems
Heating and cooling systems for JT-60 Vacuum Vessel, 9:51044 (BA;US)
Heating Systems
Heating and cooling systems for JT-60 Vacuum Vessel, 9:51044 (BA;US)
JUELICH-DIDO REACTOR
See FRJ-2 REACTOR

K

K SHELL
Polarization
Polarization transfer to inner-vacancies of ions swiftly traversing polarized ion hosts, 9:50730 (RA;AU)
K02
See KAONS NEUTRAL LONG-LIVED
KALUZA-KLEIN THEORY
Mathematical Manifolds
Fermion zero modes on parallelized and squashed group manifolds, 9:50811 (J;US)
KAONS 2
See KAONS NEUTRAL LONG-LIVED
KAONS NEUTRAL LONG-LIVED
Weak Particle Decay
Comparison of various observations of M*sub(μπ) (0.429), 9:50783 (RA;AU)
KARLSRUHE NUCLEAR RESEARCH CENTER
See KERNFORSCHUNGSZENTRUM KARLSRUHE
KENTUCKY
Oil Shale Deposits
The geology and geochemistry of Devonian Shales in South and West Central Kentucky, 9:49492 (BA;US)
Radioactive Waste Facilities
Directions in low-level radioactive waste management. Low-level radioactive waste disposal: commercial facilities no longer operating, 9:49544 (R;US)
KERNFORSCHUNGSZENTRUM KARLSRUHE
Reactor Safety
Annual report 1983 of Hauptabteilung Sicherheit, 9:49874 (R;DE;In German)
Work
Annual report 1983 of Hauptabteilung Sicherheit, 9:49874 (R;DE;In German)
KERNKRAFTWERK BIBLIS
See BIBLIS-A REACTOR
KEROSENE
Data Compilation
Petroleum supply monthly, July 1984, 9:49454 (R;US)
Prices
State Energy Price System: 1982 update, 9:49952 (R;US)
KIDNEY STONES
See CALCULI
KILAUEA VOLCANO
Lava
Heat-transfer measurements of the 1983 Kilauea lava flow, 9:49723 (J;US)
KIWI REACTORS
Test Facilities
NERVA Program. Operating procedure: cart cooling system, Test Cell A, 9:49844 (R;US)
KLYSTRONS
Harmonics
Multimode harmonic power measurement of 40 MW pulsed S-band klystrons, 9:50464 (R;US)
Performance
Multimode harmonic power measurement of 40 MW pulsed S-band klystrons, 9:50464 (R;US)
KNOCK-ON ELECTRONS
See ELECTRONS
KORTEWEG-DE VRIES EQUATION
Finite Difference Method
Gauge equivalent difference evolution equations, 9:50980 (RA;BG;In Bulgarian)
Gauge Invariance
Gauge equivalent difference evolution equations, 9:50980 (RA;BG;In Bulgarian)
Solitons
Solitons in solid state physics, 9:50973 (R;AT)
KRYPTON 75
Mass
Neutron deficient mass surface between the 1f/sub 7/2/ and 1g/sub 9/2/ shells: the masses of ^{71}Kr and ^{75}Kr, 9:50867 (R;US)
KRYPTON 77
Mass
Neutron deficient mass surface between the 1f/sub 7/2/ and 1g/sub 9/2/ shells: the masses of ^{77}Kr and ^{75}Kr, 9:50867 (R;US)
KRYPTON 84 TARGET
Proton Reactions
Description of fragmentation as a critical phenomenon in high energy p-nucleus collisions, 9:50868 (J;NL)
KRYPTON 85
Maximum Permissible Concentration
Toxicology of ^{85}Kr: chronic exposure studies, 9:50620 (J;GB)
KURCHATOVIUM
See ELEMENT 104

L

L REACTOR
Environmental Impacts
L-Reactor operation, Savannah River Plant, Aiken, SC. Draft environmental impact statement. Volume 1, 9:50584 (R;US)
L-Reactor operation, Savannah River Plant, Aiken, SC. Draft environmental impact statement. Volume 2. Appendices, 9:50585 (R;US)
L SHELL
Inner-Shell Ionization
L subshell X-ray production by 100 to 250 keV/a.m.u. ions, 9:50734 (RA;AU)
New look at the L subshell Coulomb deflection factors for inner shell ionisation, 9:50733 (RA;AU)
LABORATORY BUILDINGS
Contamination
Contamination surveys of plant room and roof-void in B. 154 at the National Physical Laboratory, Teddington, 9:50362 (R;GB)
Final report on contamination surveys at NPL, 9:50361 (R;GB)
Radiation Monitoring
Contamination surveys of plant room and roof-void in B. 154 at the National Physical Laboratory, Teddington, 9:50362 (R;GB)
Final report on contamination surveys at NPL, 9:50361 (R;GB)
LABORATORY SYSTEM
Transformations
Transformation of angular scattering probabilities between reference systems: survey and numerical analysis, 9:50827 (R;XN)
LAMBS
See SHEEP
LAMINAR FLOW
Boundary Layers
Development of self-adaptive difference method for the solution of three-dimensional laminar incompressible boundary layer equations with arctrolled error, 9:50403 (R;DE;In German)
LAMPF II SYNCHROTRON
Meetings
Proceedings of the seventeenth LAMPF Users Group meeting, 9:50446 (R;US)
Research Programs
Proceedings of the seventeenth LAMPF Users Group meeting, 9:50446 (R;US)
Specifications
LAMPF II, 9:50447 (R;US)
LAMPF LINAC
Beam Injection
Development of a high current H^- injector for the proton storage ring at LAMPF, 9:50463 (R;US)
Hydrogen 1 Minus Beams
Development of a high current H^- injector for the proton storage ring at LAMPF, 9:50463 (R;US)
Meetings
Proceedings of the seventeenth LAMPF Users Group meeting, 9:50446 (R;US)
Research Programs
Proceedings of the seventeenth LAMPF Users Group meeting, 9:50446 (R;US)
LAND FILLS
See SANITARY LANDFILLS
LAND LEASING
Government Policies
Analysis of proposed changes to federal surface mining and coal leasing policy, 9:49442 (R;US)
LAND RECLAMATION
Revegetation
Physical and chemical problems with reclamation of conifers, 9:49412 (R;US)
LANDFILLS
See SANITARY LANDFILLS
LANGMUIR OSCILLATIONS
See PLASMA WAVES
LANTHANUM
Absorption Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Activation Analysis
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Emission Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
LANTHANUM BORIDES
Evaporation
Thermionic emission and vaporization behavior of the ternary systems of lanthanum hexaboride containing molybdenum ooride, molybdenum diboride, zirconium diboride, gadolinium hexaboride, and neodymium hexaboride, 9:50168 (J;US)
Thermionic Emission
Thermionic emission and vaporization behavior of the ternary systems of lanthanum hexaboride containing molybdenum boride, molybdenum diboride, zirconium diboride, gadolinium hexaboride, and neodymium hexaboride, 9:50168 (J;US)
LANTHANUM COMPOUNDS
See also LANTHANUM BORIDES
Phonons
Phonon properties of $LaNbO_4$ deduced from heat-capacity measurements, 9:50185 (R;US)
Specific Heat
Phonon properties of $LaNbO_4$ deduced from heat-capacity measurements, 9:50185 (R;US)
LARGE COIL PROGRAM
Electronic Equipment
Assembly and installation of a pair of superconducting buses for the Large Coil Test Facility, 9:51019 (R;US)
Reviews
Experience highlights from the design and manufacture of US LCT coils, 9:51028 (R;US)
Preliminary results of the partial array LCT coil tests, 9:51029 (R;US)
LASER CAVITIES
Beam Splitting
Variable output coupler for laser cavities with totally reflecting mirrors, 9:50396 (P;US)
Couplings
Variable output coupler for laser cavities with totally reflecting mirrors, 9:50396 (P;US)
LASER RADIATION
Electrons
Evidence of a laser intensity threshold for the onset of inhibited electron transport, 9:51011 (J;GB)
Energy Transfer
Evidence of a laser intensity threshold for the onset of inhibited electron transport, 9:51011 (J;GB)
Radiation Protection
Radiation protection problems by nonionizing electromagnetic radiation in Austria, 9:50653 (R;AT)
Small Angle Scattering
Organic structure, 9:49379 (RA;US)
LASER WELDING
Mathematical Models
Two-dimensional modeling of conduction-mode laser welding, 9:50139 (R;US)
Two-Dimensional Calculations
Two-dimensional modeling of conduction-mode laser welding, 9:50139 (R;US)
LASER-PRODUCED PLASMA
Plasma Waves
Transition scattering and transition bremsstrahlung in a dense plasma - a step towards soft x-ray lasers, 9:51008 (R;HU)
LASERS
Light Amplification by Stimulated Emission of Radiation.
See also FREE ELECTRON LASERS
GAS LASERS
RING LASERS
SEMICONDUCTOR LASERS
X-RAY LASERS

Q-Switching
Modified laser-annealing process for improving the quality of electrical P-N junctions and devices, 9:50427 (P;US)
Reflective Coatings
Alumina/silica multilayer coatings for excimer lasers, 9:50395 (R;US)
LATENT HEAT STORAGE
Phase Change Materials
Composite latent/sensible energy storage media for high-temperature industrial applications, 9:49905 (R;US)
Industrial work on latent heat storage, 9:49718 (R;US)
Porous Materials
Composite latent/sensible energy storage media for high-temperature industrial applications, 9:49905 (R;US)
Research Programs
Advanced latent heat storage media for high-temperature industrial applications, 9:49907 (R;US)
LATTICE FIELD THEORY
Chiral Symmetry
Chiral-symmetry breaking in a composite model with scalars based on lattice gauge theory, 9:50809 (J;US)
Dirac Equation
Kaehler's geometric description of Dirac fields, 9:50800 (R;DE)
Matrices
Definition and general properties of the transfer matrix in continuum limit improved lattice gauge theories, 9:50802 (R;DE)
Virtual Particles
Monte Carlo calculation with unquenched Wilson-Fermions, 9:50801 (R;DE)
Wilson Loop
Monte Carlo calculation with unquenched Wilson-Fermions, 9:50801 (R;DE)
LAVA
Heat Transfer
Heat-transfer measurements of the 1983 Kilauea lava flow, 9:49723 (J;US)
LAWRENCE BERKELEY LABORATORY
Research Programs
Biology and Medicine Division annual report, 1982-1983, 9:50594 (R;US)
LAWRENCE LIVERMORE LABORATORY
Planning
Report of the Long-Range Planning Committee, 9:51047 (R;US)
LC-FINING
Specifications
Alternative modes of processing SRC in an expanded-bed LC-finer to produce low-nitrogen distillates, 9:49372 (J;US)
LEACHATES
Chemical Composition
Waste characterization, 9:49427 (RA;US)
LEAD
Foliar Uptake
Lead uptake by perennial ryegrass and radishes from air, water and soil, 9:50650 (J;CA)
Neutron Transport
Theoretical and experimental investigation on neutron transport in moderating and shielding materials, 9:50930 (RA;BG;In Bulgarian)
Root Absorption
Lead uptake by perennial ryegrass and radishes from air, water and soil, 9:50650 (J;CA)
X-Ray Fluorescence Analysis
On-stream determination of Zn-content in Zn-ore slurries by radioisotope excited X-ray fluorescence, 9:50291 (R;AT)
LEAD 200
Fission
Neutron emission from accelerating fission fragments, 9:50876 (RA;AU)
Heavy Ion Reactions
Heavy ion induced fission reactions, 9:50891 (RA;AU)
LEAD 208 TARGET
Lithium 7 Reactions
Coulomb excitation of the nucleus ^{7}Li, 9:50841 (RA;AU)
Oxygen 16 Reactions
Heavy ion excitation and photon decay of giant resonances, 9:50880 (J;FR)
Oxygen 17 Reactions
Heavy ion excitation and photon decay of giant resonances, 9:50880 (J;FR)
Pion Minus Reactions
Dependence of the excitation energy, width, and cross section of the isovector monopole resonance, 9:50878 (J;FR)
Excitation of giant resonances in pion inelastic scattering, 9:50847 (J;FR)
Pion Plus Reactions
Excitation of giant resonances in pion inelastic scattering, 9:50847 (J;FR)
LEAD 209
Energy Levels
Exponentially decreasing newtonian force in the place of Yukawa potential, 9:50898 (RA;BG;In Bulgarian)
Particle-Core Model
Exponentially decreasing newtonian force in the place of Yukawa potential, 9:50898 (RA;BG;In Bulgarian)
LEAD 210
Lung Clearance
Lung-clearance classification of radionuclides in coal fly ash, 9:49441 (J;GB)
X-Ray Fluorescence Analysis
Lung-clearance classification of radionuclides in coal fly ash, 9:49441 (J;GB)
LEAD 212
Tissue Distribution
Properties of liposomes containing 212Pb, 9:50597 (J;GB)
LEAD-ACID BATTERIES
Battery Charging
Metallic-rectifier battery chargers for lead-acid batteries. Specification No. A10-1976 (Revision of A10-1972), 9:49912 (R;US)
Electric Conductivity
Contribution to the description of the electrical behaviour of lead, nickel-cadmium, and nickel-iron accumulators, 9:49914 (R;DE;In German)
LEPTON-DEUTERON INTERACTIONS
See DEUTERIUM TARGET
LEUCOCYTES
See LEUKOCYTES
LEUKOCYTES
Gene Mutations
Mutagenic activity of nitrosamines in mammalian cells: Study with the CHO/HGPRT and human leukocyte SCE assays, 9:50642 (BA;US)
Sister Chromatid Exchanges
Mutagenic activity of nitrosamines in mammalian cells: Study with the CHO/HGPRT and human leukocyte SCE assays, 9:50642 (BA;US)
LEVEL INDICATORS
Design
High pressure liquid level monitor, 9:49424 (P;US)
Thermocouples
Binary thermoelectric level detector, 9:50497 (R;US)
Thermoelectric Materials
Binary thermoelectric level detector, 9:50497 (R;US)
LIDAR
See OPTICAL RADAR
LIE GROUPS
Global Analysis
Multiplet classification of the reducible elementary representations of real semisimple Lie groups, 9:50793 (RA;BG;In Bulgarian)
Wigner Coefficients
Wigner coefficients for semi-simple lie groups: a pattern calculus for O(n) and U(n), 9:50796 (RA;AU)
LIFE SHORTENING
See LIFE SPAN
LIFE SPAN
Delayed Radiation Effects
Toxicology of ^{85}Kr: chronic exposure studies, 9:50620 (J;GB)

LIGHT NUCLEI
For nuclei with mass 1-40.
See also BERYLLIUM 9
BORON 10
CHLORINE 40
DEUTERIUM
HELIUM 3
LITHIUM 7
MAGNESIUM 24
MAGNESIUM 29
NITROGEN 16
OXYGEN 17
OXYGEN 18
POTASSIUM 40
SODIUM 27
SULFUR 39
TRITIUM
Photonuclear Reactions
Photonuclear reactions in light nuclei, 9:50830 (RA;AU)
LIGHT WATER COOLED REACTORS
See WATER COOLED REACTORS
LIGHTING SYSTEMS
Control Systems
Lighting controls: the role of advanced technology - past, present, and future, 9:49995 (R;US)
Power Density
New lighting technologies, their status and impacts on power densities, 9:49997 (R;US)
Technology Assessment
New lighting technologies, their status and impacts on power densities, 9:49997 (R;US)
LIGNITE
Chemical Composition
Distribution of inorganics, 9:49380 (RA;US)
Low-rank coal research. Quarterly technical progress report, April-June 1984, 9:49378 (R;US)
Combustion
Ash and slag characterization, 9:49431 (RA;US)
Combustion research and ash fouling, 9:49428 (RA;US)
Low-rank coal research. Quarterly technical progress report, April-June 1984, 9:49378 (R;US)
Particulate characterization, 9:49753 (RA;US)
SO/sub x//NO/sub x/ control, 9:49752 (RA;US)
Comparative Evaluations
Distribution of inorganics, 9:49380 (RA;US)
Dielectric Properties
Physical properties and moisture, 9:49381 (RA;US)
Drying
Coal-water slurry preparation, 9:49421 (RA;US)
Low-rank coal/water slurry combustion, 9:49430 (RA;US)
Fluidized-Bed Combustion
Fluidized bed combustion of low-rank coals, 9:49429 (RA;US)
Fracture Properties
Physical properties and moisture, 9:49381 (RA;US)
Infrared Spectra
Novel analytical approaches to the study of coal beneficiation. Quarterly report, 9:49382 (R;US)
Meetings
Low-rank coal research. Quarterly technical progress report, April-June 1984, 9:49378 (R;US)
Molecular Weight
Organic structure, 9:49379 (RA;US)
Oxidation
Novel analytical approaches to the study of coal beneficiation. Quarterly report, 9:49382 (R;US)
Physical Properties
Physical properties and moisture, 9:49381 (RA;US)
Research Programs
Low-rank coal research. Quarterly technical progress report, April-June 1984, 9:49378 (R;US)
Sampling
Ash and slag characterization, 9:49431 (RA;US)
Structural Chemical Analysis
Organic structure, 9:49379 (RA;US)
LIMBS
Pathological Changes
Plutonium-induced wounds in beagles, 9:50621 (J;GB)
LIMESTONE
Sorptive Properties
Analytical model for freeboard and in-bed limestone sulfation in fluidized-bed coal combustors, 9:49434 (J;GB)
LIMITERS
Design
Design and fabrication of a beryllium limiter for ISX-B, 9:51027 (R;US)
Fabrication
Design and fabrication of a beryllium limiter for ISX-B, 9:51027 (R;US)
Interactions
Plasma surface interaction processes and possible synergisms, 9:51026 (R;US)
LINACS
See LINEAR ACCELERATORS
LINEAR ACCELERATORS
See also FMIT LINAC
LAMPF LINAC
STANFORD 20-GEV LINAC
STANFORD LINEAR COLLIDER
Neutron Sources
DIANE-a project for a new high performance neutron source in the Federal Republic of Germany, 9:50462 (RA;SU)
X-Ray Sources
Portable radiography using linear accelerators, 9:49572 (R;US)
LIPOSOMES
Chemical Preparation
Properties of liposomes containing 212Pb, 9:50597 (J;GB)
LIQUEFIED NATURAL GAS
Fuel Substitution
Liquid gas operation, 9:50088 (RA;DD;In German)
LIQUEFIED PETROLEUM GASES
Data Compilation
Petroleum supply monthly, July 1984, 9:49454 (R;US)
Prices
State Energy Price System: 1982 update, 9:49952 (R;US)
LIQUID CRYSTALS
Crystal Structure
Synchrotron x-ray study of the orientational ordering D2-D1 structural phase transition of freely suspended discotic strands in triphenylene hexa-n-dodecanoate, 9:50320 (J;US)
Crystal-Phase Transformations
Synchrotron x-ray study of the orientational ordering D2-D1 structural phase transition of freely suspended discotic strands in triphenylene hexa-n-dodecanoate, 9:50320 (J;US)
LIQUID METAL TEST FACILITIES
See TEST FACILITIES
LIQUID METAL-WATER REACTIONS
See MOLTEN METAL-WATER REACTIONS
LIQUID-PHASE SINTERING
See SINTERING
LITHIUM
Absorption Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Activation Analysis
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Emission Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Liquid Column Chromatography
Separation of lithium ions by chromatography, 9:50259 (R;US)
LITHIUM 6 TARGET
Neutron Reactions
Measurements of angular distributions for the ^{6}Li(n,t)^{4}He reaction in the MeV region, 9:50838 (RA;AU)
LITHIUM 7
Coulomb Excitation
Coulomb excitation of the nucleus ^{7}Li, 9:50841 (RA;AU)
Energy Levels
Coulomb excitation of the nucleus ^{7}Li, 9:50841 (RA;AU)
LITHIUM 7 REACTIONS
Charge-Exchange Reactions
Interaction of ^{7}Li with ^{16}O at 50 MeV, 9:50839 (RA;AU)
LITHIUM 7 TARGET
Neutron Reactions
Neutron nuclear data of ^{7}Li adopted in JENDL-2, 9:50845 (R;JP)

LITHIUM ALLOYS
Binary Alloy Systems
Development of a melting apparatus for lithium-containig magnesium-aluminium alloys and its application in thermal analysis, 9:50135 (R;DE;In German)
Brinell Hardness
Phase equilibria in aluminium-lithium-magnesium alloys at 200°C, 300°C and 400°C and their hardening in a casting state, 9:50134 (R;DE;In German)
Lattice Parameters
Defects and disorder in the fast-ion electrode lithium-aluminum, 9:49915 (J;US)
Order Parameters
Defects and disorder in the fast-ion electrode lithium-aluminum, 9:49915 (J;US)
Phase Diagrams
Development of a melting apparatus for lithium-containig magnesium-aluminium alloys and its application in thermal analysis, 9:50135 (R;DE;In German)
Phase Studies
Phase equilibria in aluminium-lithium-magnesium alloys at 200°C, 300°C and 400°C and their hardening in a casting state, 9:50134 (R;DE;In German)
Ternary Alloy Systems
Development of a melting apparatus for lithium-containig magnesium-aluminium alloys and its application in thermal analysis, 9:50135 (R;DE;In German)

LITHIUM CARBONATES
Chemical Reaction Kinetics
Development of a hot gas cleanup system for integrated coal gasification/molten carbonate fuel cell power plants, 9:49341 (RA;US)

LITHIUM FLUORIDES
Atom Collisions
Observation of single phonon scattering of Ne^{20}-atoms from a LiF (001) surface, 9:50749 (R;AT)

LITHIUM IODIDES
Decomposition
Fluctuation experiments on atomic and molecular systems using the one-atom detector, 9:50339 (J;NL)
Excitation
Fluctuation experiments on atomic and molecular systems using the one-atom detector, 9:50339 (J;NL)
Structural Chemical Analysis
Fluctuation experiments on atomic and molecular systems using the one-atom detector, 9:50339 (J;NL)

LITHOTYPES
Separation Processes
Distribution of inorganics, 9:49380 (RA;US)

LMFBR TYPE REACTORS
Cost
Technical reference book for the Energy Economic Data Base (EEDB) Program, 9:49791 (R;US)
Economics
Technical reference book for the Energy Economic Data Base (EEDB) Program, 9:49791 (R;US)
Fuel-Coolant Interactions
KANDY - a numerical model to describe phenomena, which - in a heated and voided fuel element of an LMFBR - may occur, 9:49882 (R;DE;In German)
Loss of Flow
Evaluation of the core physics and safety characteristics of a quasi-homogeneous LMFBR concept, 9:49849 (R;US)
Nuclear Data Collections
Status of nuclear data of importance for LMFBR applications prior to the evaluation of ENDF/B-VI, 9:49782 (R;US)
Steam Generators
MINET simulation of a helical coil sodium/water steam generator, including structural effects, 9:49892 (R;US)
MINET validation study using steam generator transient data, 9:49893 (R;US)

LNG
See LIQUEFIED NATURAL GAS

LOAD MANAGEMENT
Optimization
Studies on load management in the range of minute-to-minute up to hour-to-hour planning by means of dynamic optimization, 9:49760 (R;DE;In German)

LOCA
See LOSS OF COOLANT

LOCAL GOVERNMENT
Emergency Plans
Low-cost approach to local government energy contingency planning, 9:49947 (R;US)
Energy Conservation
Development of a community energy conservation program. Guide to organizing and managing a program. Volume I, 9:50065 (R;US)
Solar access protection: executive summaries of the 1981-1982 Bonneville Power financial assistance grants to local governments, 9:49601 (R;US)
Financial Assistance
Solar access protection: executive summaries of the 1981-1982 Bonneville Power financial assistance grants to local governments, 9:49601 (R;US)

LOS ALAMOS MESON PHYSICS FACILITY
See LAMPF LINAC

LOSS OF COOLANT
Computer Calculations
Austrian contributions to fuel rod failure models shown at the International Standard Problem ISP-14 (BALON-2A code), 9:49896 (R;AT;In German)
Heat Transfer
HTCC - a heat transfer model for gas-steam mixtures, 9:49846 (R;DE;In German)
SSYST-3. Input description, 9:49873 (R;DE;In German)
Hydraulics
SSYST-3. Input description, 9:49873 (R;DE;In German)

LOSS OF FLOW
After-Heat Removal
Safety conception of the high temperature reactor with natural heat removal decay in the case of accidents, 9:49860 (R;DE;In German)
Reactor Core Disruption
Evaluation of the core physics and safety characteristics of a quasi-homogeneous LMFBR concept, 9:49849 (R;US)

LOSSES (ENERGY)
See ENERGY LOSSES

LOUISIANA
Climates
Consideration of future climatic changes in three geologic settings, 9:49554 (R;US)
Natural Gas Wells
Subsidence monitoring in conjunction with methane gas production in Louisiana (phase 1, deep well program). Annual report November 1981-January 1983, 9:49481 (R;US)

LOW LEVEL COUNTING
Sensitivity
Detectable limits of low-level concentration of the radionuclides, 9:50479 (RA;BG;In Bulgarian)

LOW-HEAD HYDROELECTRIC POWER PLANTS
Prior to August 1978 HYDROELECTRIC POWER PLANTS was used.
Turbines
Low head, micro-hydro demonstration project, Coker, Alabama. Final report, 9:49595 (R;US)

LOW-LEVEL RADIOACTIVE WASTES
Combustion
Incineration of hazardous and low-level radioactive waste by a small generator. Final report, 9:49564 (R;US)
Government Policies
Directions in low-level radioactive-waste management. Planning state policy on low-level radioactive waste, 9:49542 (R;US)
Radioactive Waste Disposal
Directions in low-level radioactive-waste management. Incentives and compensation: providing resources for communities hosting low-level waste facilities, 9:49543 (R;US)

Directions in low-level radioactive-waste management. Planning state policy on low-level radioactive waste, 9:49542 (R;US)
Directions in low-level radioactive waste management. Low-level radioactive waste disposal: commercial facilities no longer operating, 9:49544 (R;US)
Exposure and risk calculations for disposal of wastes having minimal radioactivity, 9:49566 (R;US)
Radioactive Waste Management
Commission enforcement. National Low-Level Radioactive Waste Management Program, 9:49547 (R;US)
Directions in low-level radioactive-waste management. Incentives and compensation: providing resources for communities hosting low-level waste facilities, 9:49543 (R;US)
Directions in low-level radioactive-waste management. Planning state policy on low-level radioactive waste, 9:49542 (R;US)
Directions in low-level radioactive waste management. Low-level radioactive waste disposal: commercial facilities no longer operating, 9:49544 (R;US)
Waste Management Program. Technical progress report, July-September 1983, 9:49549 (R;US)
Radioactive Waste Processing
Incineration of hazardous and low-level radioactive waste by a small generator. Final report, 9:49564 (R;US)

LP-GAS
See LIQUEFIED PETROLEUM GASES

LR-0 REACTOR
Reactor Protection Systems
Reliability analysis of LR-0 reactor accident alarm system, 9:49859 (RA;CS;In Czech)

LUMINESCENT CONCENTRATORS
Luminescent solar concentrators for energy conversion, 9:49714 (BA;DE)
Dyes
Fluorescent dyes for luminescent solar concentrators. Final report, 9:49703 (R;DE;In German)

LUNG CLEARANCE
Biological Models
Lung-clearance classification of radionuclides in coal fly ash, 9:49441 (J;GB)

LURGI PROCESS
Waste Water
Evaluation of two conceptual wastewater treatment schemes for a Lurgi-based indirect coal liquefaction plant, 9:49360 (R;US)

LUTETIUM 175 TARGET
Neutron Reactions
Isomer ratio calculations using modeled discrete levels, 9:50893 (R;US)

LUTETIUM 176
E1-Transitions
Absolute dipole gamma-ray strength functions for ^{178}Lu, 9:50894 (R;US)
M1-Transitions
Absolute dipole gamma-ray strength functions for ^{178}Lu, 9:50894 (R;US)

LWR TYPE REACTORS
See WATER COOLED REACTORS

M

MA 754
See NICKEL BASE ALLOYS

MA 956
See IRON BASE ALLOYS

MACERALS
Reflectivity
Ultra-fine coal characterization. 2nd quarterly report, June 1, 1984-August 31, 1984, 9:49383 (R;US)

MACHINE TOOLS
Accuracy
Power of deterministic thinking in machine tool accuracy, 9:50382 (R;US)

MAGELLANIC CLOUDS
Cosmic Gamma Bursts
N49: the site of a gamma-ray burst. Preliminary results from X-ray observations, 9:50713 (BA;NL)

MAGIC NUCLEI
Intersecting Boson Model
Relation between the variable moment of inertia model and the interacting boson model, 9:50924 (BA;JP)
VMI Model
Relation between the variable moment of inertia model and the interacting boson model, 9:50924 (BA;JP)

MAGIC NUMBERS
See MAGIC NUCLEI

MAGNESIUM
Absorption Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Activation Analysis
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Electron Correlation
Basic studies of atomic dynamics. Progress report, September 1, 1983-July 31, 1984, 9:50727 (R;US)
Emission Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)

MAGNESIUM 24
Compound Nuclei
Nuclear molecules in TDHF, 9:50834 (R;US)
Giant Resonance
Chaos near the Coulomb barrier. Nuclear molecules, 9:50833 (R;US)

MAGNESIUM 24 TARGET
Electron Reactions
Analyses of electron and proton scattering to low excitation isoscalar states in ^{20}Ne, ^{24}Mg and ^{28}Si, 9:50856 (R;AU)
Oxygen 16 Reactions
Parity-dependence of the nucleus-nucleus potential and ^{16}O + ^{24}Mg elastic scattering at theta sub(c.m.)=90^{0}, 9:50852 (RA;AU)
Proton Reactions
Analyses of electron and proton scattering to low excitation isoscalar states in ^{20}Ne, ^{24}Mg and ^{28}Si, 9:50856 (R;AU)

MAGNESIUM 26 TARGET
Oxygen 18 Reactions
Masses and level schemes of very neutron-rich nuclei with A approximately 30, 9:50851 (RA;AU)

MAGNESIUM 29
Mass
Masses and level schemes of very neutron-rich nuclei with A approximately 30, 9:50851 (RA;AU)

MAGNESIUM ALLOYS
Binary Alloy Systems
Development of a melting apparatus for lithium-containig magnesium-aluminium alloys and its application in thermal analysis, 9:50135 (R;DE;In German)
Brinell Hardness
Phase equilibria in aluminium-lithium-magnesium alloys at 200°C, 300°C and 400°C and their hardening in a casting state, 9:50134 (R;DE;In German)
Phase Diagrams
Development of a melting apparatus for lithium-containig magnesium-aluminium alloys and its application in thermal analysis, 9:50135 (R;DE;In German)
Phase Studies
Phase equilibria in aluminium-lithium-magnesium alloys at 200°C, 300°C and 400°C and their hardening in a casting state, 9:50134 (R;DE;In German)
Ternary Alloy Systems
Development of a melting apparatus for lithium-containig magnesium-aluminium alloys and its application in thermal analysis, 9:50135 (R;DE;In German)

MAGNET COILS
Cost
Impact of maximum TF magnetic field on performance and cost of an advanced physics tokamak, 9:51025 (R;US)
Design
INTOR phase IIA, magnet system design - European contribution, 9:51034 (R;DE)
Stress Analysis
Using PAFEC as a preprocessor for MSC/NASTRAN, 9:51023 (R;US)
MAGNET CORES
Design
Laminated grid and web magnetic cores, 9:50385 (P;US)
Grids
Laminated grid and web magnetic cores, 9:50385 (P;US)
MAGNETIC COILS
See MAGNET COILS
MAGNETIC FIELDS
Biological Effects
Effects of electromagnetic fields produced by high voltage transmission lines. Final report, 9:50652 (R;US)
MAGNETIC MIRROR CONFIGURATIONS
Reviews
Evolution of the mirror approach to fusion: some conjectures, 9:51038 (R;US)
MAGNETIC MONOPOLES
Symmetry Breaking
Magnetic monopoles and fractional Witten indices, 9:50798 (J;US)
MAGNETIC STORAGE DEVICES
Magnetic Tapes
Beginner's guide to blocked records on magnetic tape, 9:51058 (R;US)
MAGNETOHYDRODYNAMICS
Yang-Mills Theory
Planar incompressible Yang-Mills magnetohydrodynamics, 9:50757 (J;IT)
MAGNETOSPHERE
Charged Particles
Characteristics of the magnetospheric source of interplanetary energetic particles, 9:50716 (R;US)
Trapped Protons
Trapped-proton energy spectrum determination (M0002-1), 9:50715 (R;US)
MAHOGANY TREES
See TREES
MAINTENANCE
Meetings
Experts' meeting: Maintenance '83. Maintenance and reliability, 9:50368 (R;DE;In German)
MALIGNANCIES
See NEOPLASMS
MAN
All of mankind, of any age or of either sex.
Delayed Radiation Effects
Radiobiological basis of radiation hygiene, 9:50612 (RA;NL;In Dutch)
Early Radiation Effects
Radiobiological basis of radiation hygiene, 9:50612 (RA;NL;In Dutch)
MANCHESTER LIVERPOOL UNIVERSITY RESEARCH
See URR REACTOR
MANGANESE
Absorption Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Activation Analysis
Neutron activation analysis on a series of human gallstones, 9:50272 (RA;AU)
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Emission Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Soil Chemistry
Attenuation of chemical elements in acidic leachates from coal mineral wastes by soils, 9:49407 (R;US)
MANGANESE 56
Hot Atom Chemistry
Model for the mechanism of stabilization of the Mn-56 "hot" atom and the obtaining of its different valent forms through the (n,) reaction in solid $KMnO_4$, 9:50349 (RA;BG;In Bulgarian)
Stabilization
Model for the mechanism of stabilization of the Mn-56 "hot" atom and the obtaining of its different valent forms through the (n,) reaction in solid $KMnO_4$, 9:50349 (RA;BG;In Bulgarian)
MANGANESE FLUORIDES
X-Ray Spectra
Extended x-ray absorption fine structure in photoelectron emission, 9:50304 (J;US)
MANIPULATORS
Design
Dual arm master controller concept, 9:49515 (R;US)
MANNOMUSTINE
See ALKYLATING AGENTS
MANUFACTURERS
Surveys
Energy management assistance for small and medium-size manufacturers. An evaluation of the EADC program, 9:49979 (R;US)
Manufacturing costs, equipment needs and technological opportunities among small and medium-size manufacturers, 9:50034 (R;US)
Technology Utilization
Manufacturing costs, equipment needs and technological opportunities among small and medium-size manufacturers, 9:50034 (R;US)
MANUFACTURING
Cost
Manufacturing costs, equipment needs and technological opportunities among small and medium-size manufacturers, 9:50034 (R;US)
Energy Audits
Energy management assistance for small and medium-size manufacturers. A first-stage evaluation of the 1983-1984 EADC program, 9:49970 (R;US)
Equipment
Manufacturing costs, equipment needs and technological opportunities among small and medium-size manufacturers, 9:50034 (R;US)
MANUFACTURING FACILITIES
See INDUSTRIAL PLANTS
MANURES
Anaerobic Digestion
Biomethanization plant in Baillonville, 9:49580 (R;LU)
Economic optimization of anaerobic fermenter designs for beef production units, 9:49583 (BA;US)
Gasification
Economic feasibility of cattle manure as a chemical feedstock, 9:49588 (BA;US)
MARICULTURE
See AQUACULTURE
MARS PLANET
Magnetic Fields
Magnetic field of Mars: implications from gasdynamics modeling, 9:50686 (R;US)
MASS SPECTROMETERS
Comparative Evaluations
Advanced mass spectrometers for hydrogen isotope analyses, 9:50496 (R;US)
MASS SPECTROSCOPY
High-sensitivity mass spectrometry with a tandem accelerator, 9:50449 (J;IT)
MASSACHUSETTS INSTITUTE OF TECHNOLOGY ALC
See ALCATOR DEVICE
MATERIALS
See also BIOLOGICAL MATERIALS
BUILDING MATERIALS
COMPOSITE MATERIALS
ENVIRONMENTAL MATERIALS
HAZARDOUS MATERIALS
MOLDING MATERIALS

PHASE CHANGE MATERIALS
POROUS MATERIALS
REACTOR MATERIALS
SEMICONDUCTOR MATERIALS
SHIELDING MATERIALS
THERMONUCLEAR REACTOR MATERIALS
TOXIC MATERIALS

Research Programs
Advanced Research and Technology Development Fossil Energy Materials Program. Quarterly progress report ending June 30, 1984, 9:50094 (R;US)
Emerging role of the national laboratory in the development and transfer of materials technology, 9:50089 (R;US)
Materials Sciences programs, Fiscal Year 1984, 9:50090 (R;US)

Technology Assessment
Advanced Research and Technology Development Fossil Energy Materials Program. Quarterly progress report ending June 30, 1984, 9:50094 (R;US)

Technology Transfer
Advanced Research and Technology Development Fossil Energy Materials Program. Quarterly progress report ending June 30, 1984, 9:50094 (R;US)

Wear Resistance
Relations between material properties and performance of wear resistant materials, 9:50161 (R;DE;In German)

MATERIALS (ANTIFERROMAGNETIC)
See ANTIFERROMAGNETIC MATERIALS

MATERIALS (BIOLOGICAL)
See BIOLOGICAL MATERIALS

MATERIALS (BUILDING)
See BUILDING MATERIALS

MATERIALS (COMPOSITE)
See COMPOSITE MATERIALS

MATERIALS (ENVIRONMENTAL)
See ENVIRONMENTAL MATERIALS

MATERIALS (FERROMAGNETIC)
See FERROMAGNETIC MATERIALS

MATERIALS (POROUS)
See POROUS MATERIALS

MATERIALS (SEMICONDUCTOR)
See SEMICONDUCTOR MATERIALS

MATERIALS (SHIELDING)
See SHIELDING MATERIALS

MATERIALS TESTING REACTORS
For testing properties of materials or equipment in a radioactive environment.
See also FRJ-2 REACTOR

Reactor Cores
Benchmark calculations for MTR type cores, 9:49841 (R;PK)

MEAT

Radiopreservation
Meat symposium. The vital role of science and technology in the meat industry, 9:50613 (R;ZA)

MEDICINE
See also INDUSTRIAL MEDICINE

Meetings
22. Annual congress - The South African Society of Pathologists; The International Academy of Pathology; The Southern African Society of Haematology; The South African Association of Clinical Biochemists. Programme, 9:50593 (R;ZA)

MELANOCYTES
See ANIMAL CELLS

MELANOMAS

Neutron Capture Therapy
Microscopic determination of ^{10}B for boron neutron capture therapy of malignant melanoma, 9:50279 (RA;AU)

MELTDOWN

Computer Codes
MARCH 2 (Meltdown Accident Response Characteristics) code description and user's manual, 9:49894 (R;US)

Containment
Benefit effort relation of sacrificial layers, 9:49845 (R;DE;In German)

Fission Product Release
Investigation of the meltdown accident with special regard to the radiological state of knowledge, 9:49847 (R;DE;In German)
Release of radioactivity and formation of aerosols during LWR core meltdown, 9:49881 (RA;DE;In German)

Foundations
Benefit effort relation of sacrificial layers, 9:49845 (R;DE;In German)

Radioactive Aerosols
Investigation of the meltdown accident with special regard to the radiological state of knowledge, 9:49847 (R;DE;In German)

Reactor Safety
Investigation in the BETA-test facility into the interaction between a core melt and concrete, 9:49868 (RA;DE;In German)

MEMORY DEVICES
See also MAGNETIC STORAGE DEVICES

Data Processing
Analytical model for an input/output-subsystem, 9:51055 (R;DE;In German)

MENDELEEV PERIODIC SYSTEM
See PERIODIC SYSTEM

MERCAPTANS
See THIOLS

MERCURY

Chemical State
Organic and inorganic mercury species in the Ft. Lewis solvent refined coal pilot plant water treatment process. Technical report, 9:49361 (R;US)

Monitoring
First estimate of annual mercury flux at the Kilauea main vent, 9:50536 (J;GB)

Quantitative Chemical Analysis
Mercury species present in smoke from coal fire. Water soluble mercury species in air and precipitation, 9:50530 (R;SE;In Swedish)

MERCURY 188

Isomeric Nuclei
Quadrupole moments of the 12^+ isomers in mercury 188 and mercury 190, 9:50888 (RA;AU)

MERCURY 190

Energy Levels
Alignment of neutrons and protons in rotating $^{190\ 192\ 194}Hg$ nuclei, 9:50900 (RA;AU)

Isomeric Nuclei
Quadrupole moments of the 12^+ isomers in mercury 188 and mercury 190, 9:50888 (RA;AU)

MERCURY 192

Energy Levels
Alignment of neutrons and protons in rotating $^{190\ 192\ 194}Hg$ nuclei, 9:50900 (RA;AU)

MERCURY 194

Energy Levels
Alignment of neutrons and protons in rotating $^{190\ 192\ 194}Hg$ nuclei, 9:50900 (RA;AU)

MERCURY ISOTOPES
See also MERCURY 188
MERCURY 190
MERCURY 192
MERCURY 194

High Spin States
Bose-fermi U(6/2j+1) supersymmetries and high spin anomalies, 9:50903 (R;AU)

Interacting Boson Model
Bose-fermi U(6/2j+1) supersymmetries and high spin anomalies, 9:50903 (R;AU)

MESON RESONANCES
See also CHARMED MESON RESONANCES
UPSILON RESONANCES
VECTOR MESONS

Hadronic Particle Decay
Heavy quark physics, 9:50785 (RA;SU;In Russian)

Leptonic Decay
Heavy quark physics, 9:50785 (RA;SU;In Russian)

Particle Decay
Rho decay in the cloudy bag model, 9:50808 (RA;AU)

MESON-DEUTERON INTERACTIONS
See DEUTERIUM TARGET

METAGALAXY
See UNIVERSE
METALLIC GLASSES
Neutron Diffraction
Neutron diffraction experiments on amorphous alloys, 9:50131 (R;HU)
Physical Radiation Effects
Neutron induced irradiation damage in amorphous Fe40Ni40B20, 9:50188 (R;DE;In German)
METALLOGRAPHY
Limited to the branch of metallurgy concerned with the preparation and examination of the surface of metals.
Sample Preparation
Metallographic grinding efficiency, 9:50414 (R;US)
METALS
See also ACTINIDES
ALKALI METALS
ALUMINUM
ANTIMONY
BISMUTH
CADMIUM
GERMANIUM
LEAD
MERCURY
TRANSITION ELEMENTS
ZINC
Electric Conductivity
Resistivity of alloys, 9:50946 (R;US)
Electroplating
Electroless metal plating of plastics, 9:50179 (P;US)
Ferromagnetism
Ferromagnetism in metals at finite temperatures, 9:50945 (R;US)
Grain Boundaries
Atomistic studies of grain boundaries with segregated impurities. Final progress report, July 1983-June 30, 1984, 9:50108 (R;US)
Ion Implantation
Fundamental aspects on ion-beam surface modification: defect production and migration processes, 9:50105 (R;US)
Laser Beam Machining
Slag capture and removal during laser cutting, 9:50147 (P;US)
Multi-Element Analysis
Development of an analytical procedure for the determination of traces of dissolved heavy metals in seawater by means of total reflection X-ray fluorescence analysis, 9:50266 (R;DE;In German)
Research Programs
Metals and Ceramics Division progress report for period ending June 30, 1984, 9:50093 (R;US)
METAL-WATER REACTIONS
See MOLTEN METAL-WATER REACTIONS
METEOROIDS
Chemical Composition
Chemical and isotopic measurements of micrometeoroids by secondary ion mass spectrometry (A0187-2), 9:50680 (R;US)
Isotope Ratio
Chemical and isotopic measurements of micrometeoroids by secondary ion mass spectrometry (A0187-2), 9:50680 (R;US)
METEORS
See METEOROIDS
METHANE
Chemical Reaction Kinetics
Rate determination for F + CH_4 by real-time competitive kinetics, 9:50342 (J;NL)
Production
Biomethanization plant in Baillonville, 9:49580 (R;LU)
Economic optimization of anaerobic fermenter designs for beef production units, 9:49583 (BA;US)
Size distribution of airborne particulate matter emitted by the front-end processing of municipal solid waste feed material for large-scale anaerobic digesters, 9:49581 (J;US)
METHANE HYDRATES
See GAS HYDRATES
METHANOL PLANTS
Waste Water
Evaluation of two conceptual wastewater treatment schemes for a Lurgi-based indirect coal liquefaction plant, 9:49360 (R;US)
METHYL VIOLOGEN
See BIPYRIDINES
METHYLAMINE
Chemical Preparation
Method of preparing $(CH_3)_3SiNSO$ and byproducts thereof, 9:50292 (P;US)
METHYLBENZENE
See TOLUENE
2-METHYLBUTANE
Chemical Reactions
Reactions of $FeCH_3i$ and $CoCH_3^+$ with aliphatic alkanes in the gas phase, 9:50322 (J;US)
2-METHYLPROPANE
Chemical Reactions
Reactions of $FeCH_3^+$ and $CoCH_3^+$ with aliphatic alkanes in the gas phase, 9:50322 (J;US)
MEXICO
Continental Shelf
Summary of United States-Canada and United States-Mexico maritime boundary disputes in relationship to hydrocarbon resources, 9:49469 (R;US)
Energy Demand
Energy demand in the transportation sector of Mexico, 9:49944 (R;US)
MFTF DEVICES
Prior to October 1977, MX DEVICES was used to index this concept.
Design
MFTF-α+T: an upgrade to the MFTF-B, 9:51020 (R;US)
Impurities
Plasma-surface interactions in large tandem mirror devices - MFTF-B, 9:51009 (R;US)
Superconducting Magnets
D-T axicell magnet system for MFTF-α+T, 9:51021 (R;US)
MICELLAR-POLYMER FLOODING
See MICROEMULSION FLOODING
MICROBIAL PROCESSES
See ANAEROBIC DIGESTION
MICROELECTRONICS
Fabrication
Dry etching of metallization, 9:50422 (R;US)
MICROEMULSION FLOODING
Evaluation
Project evaluation: Penn Grade Micellar Displacement Project, 9:49446 (R;US)
Field Tests
Project evaluation: Penn Grade Micellar Displacement Project, 9:49446 (R;US)
MICROSEISMIC MONITORING
See ACOUSTIC MONITORING
MICROWAVE AMPLIFIERS
Research Programs
60 GHz Gyrotron Development Program. Quarterly report No. 18, October-December 1983, 9:51035 (R;US)
MICROWAVE RADIATION
Radiation Protection
Radiation protection problems by nonionizing electromagnetic radiation in Austria, 9:50653 (R;AT)
MIDDLE DISTILLATES
See PETROLEUM DISTILLATES
MIGRATION (RADIONUCLIDE)
See RADIONUCLIDE MIGRATION
MILITARY EQUIPMENT
Diesel Engines
Military adaptation of commercial items (MACI) laboratory evaluation of the Code E-430 engine. Final report, 9:50067 (R;US)
Military adaptation of commercial items: laboratory evaluation of the Code E-436 engine. Technical report 17 January-28 July 1983, 9:50068 (R;US)
MILL TAILINGS
Grouting
Grouting of uranium mill tailings piles, 9:49541 (R;US)

Remedial Action
Feasibility of the use of nuclear-emulsion techniques in the study of drill core and water samples from the Monticello mill, Monticello, Utah, 9:49568 (R;US)
Grouting of uranium mill tailings piles, 9:49541 (R;US)
Stabilization
Grouting of uranium mill tailings piles, 9:49541 (R;US)
MINE RESCUE
Technical equipment for rescuing injured miners in case of roof breaks in coal faces and roadways, 9:49439 (R;DE;In German)
MINE-MOUTH GENERATING PLANTS
See FOSSIL-FUEL POWER PLANTS
MINERAL RESOURCES
See also COAL DEPOSITS
NATURAL GAS DEPOSITS
OIL SHALE DEPOSITS
PETROLEUM DEPOSITS
Maps
Geologic map and mineral resources summary of the Sewanee Quadrangle, Tennessee, 9:49408 (R;US)
MINERAL WASTES
Fluidized-Bed Combustion
Fluidization 1980 conference: [summary of workshop discussions], 9:49426 (R;US)
Leachates
Attenuation of chemical elements in acidic leachates from coal mineral wastes by soils, 9:49407 (R;US)
MINERALS
See also ZEOLITES
Phase Transformations
Ash and slag characterization, 9:49431 (RA;US)
Combustion research and ash fouling, 9:49428 (RA;US)
MINING EQUIPMENT
Human Factors Engineering
Extension of low coal canopy technology to include drilling and cutting machines. Open file report 19 December 1980-15 June 1983, 9:49417 (R;US)
Safety Engineering
Extension of low coal canopy technology to include drilling and cutting machines. Open file report 19 December 1980-15 June 1983, 9:49417 (R;US)
MIRROR FUSION TEST FACILITY
See MFTF DEVICES
MIRRORS
Concentration Ratio
Analytical optical power concentration calculations for reflection for spherical mirrors, 9:49713 (BA;US)
Optical Reflection
Analytical optical power concentration calculations for reflection for spherical mirrors, 9:49713 (BA;US)
MISONIDAZOLE
Radiosensitivity Effects
Hypoxic cell sensitizers and heavy charged particle beams may play complementary roles in killing hypoxic tumor cells, 9:50618 (J;US)
MISSISSIPPI
Climates
Consideration of future climatic changes in three geologic settings, 9:49554 (R;US)
MIXING
Not for CONFIGURATION MIXING.
Mathematical Models
Models for mixture experiments when the response depends on the total amount, 9:50359 (R;US)
MIXTURES
See also SLURRIES
Computer Codes
User's guide to MIX: a computer code for fitting mixture distributions to data, 9:51051 (R;US)
Mathematical Models
Models for mixture experiments when the response depends on the total amount, 9:50359 (R;US)
MOBIL M-GASOLINE PROCESS
Waste Water
Evaluation of two conceptual wastewater treatment schemes for a Lurgi-based indirect coal liquefaction plant, 9:49360 (R;US)
MOBILITY
Not for material movement; see also TRANSPORT.
Control
Enhanced oil recovery by CO_2 foam flooding. Quarterly report, July 1-September 30, 1984, 9:49448 (R;US)
MODELS (COSMOLOGICAL)
See COSMOLOGICAL MODELS
MODERATELY ENRICHED URANIUM
5 - 80 per cent.
Reactivity
Calculations of K with burn-up for various enrichments for MTR type core, 9:49842 (R;PK)
MODIFIED IN-SITU PROCESSES
Tracer Techniques
Investigation of tracer tests on the Western Research Institute 10-ton retort, 9:49496 (R;US)
MOLDING MATERIALS
Chemical Composition
Method and composition for molding low density desiccant syntactic foam articles, 9:50180 (P;US)
MOLECULAR BEAMS
Photoelectron Spectroscopy
Vacuum ultraviolet photoionization of cold molecular beams, 9:50720 (R;US)
MOLECULAR MODELS
Reliability
Kinetics - studies I. Model experiments with dehydrogenation of propane and isomerization of pentane, 9:50319 (R;NO;In Norwegian)
MOLECULAR WEIGHT
Measuring Methods
Organic structure, 9:49379 (RA;US)
MOLTEN CARBONATE FUEL CELLS
Prior to June 1980 this information was indexed with the descriptors HIGH-TEMPERATURE FUEL CELLS + MOLTEN SALTS + CARBONATES.
Fuel Gas
Contaminant control in hot coal derived gas streams: proceedings, 9:49388 (R;US)
Hot-gas chloride cleanup for molten carbonate fuel cells, 9:49339 (RA;US)
Overview to DOE/Fossil Energy's gas stream contaminant control program, 9:49336 (RA;US)
Zinc ferrite hydrogen sulfide absorbent, 9:49340 (RA;US)
Fuel Systems
Development of a hot gas cleanup system for integrated coal gasification/molten carbonate fuel cell power plants, 9:49341 (RA;US)
H_2S removal using mixed metal oxides and HCl removal using molten alkali carbonates, 9:49342 (RA;US)
Metal/metal oxides as high temperature desulfurization sorbents, 9:49338 (RA;US)
Materials
Advanced Research and Technology Development Fossil Energy Materials Program. Quarterly progress report ending June 30, 1984, 9:50094 (R;US)
Poisoning
Update of the sulfur tolerance of molten carbonate fuel cells, 9:49964 (RA;US)
Research Programs
Status and update of the DOE Molten Carbonate Fuel Cell Program, 9:49963 (RA;US)
MOLTEN METAL-WATER REACTIONS
Test Facilities
Experiment for triggered fragmentation with a molten copper-drop in water, 9:50401 (R;DE;In German)
MOLTEN SALT COOLANTS
See MOLTEN SALTS
MOLTEN SALTS
Chemical Reaction Kinetics
The behavior of water in molten salts, 9:50332 (J;US)
Molecular Structure
Molecular dynamics calculations of MAX_4 melts, 9:50312 (J;US)

Performance
Operation and control of a solar molten salt steam generating system, 9:49675 (BA;US)
MOLYBDENUM
Catalytic Effects
Catalysts for gasification of biomass, 9:49586 (R;US)
MOLYBDENUM ALLOYS
See also ALLOY-IN-100
INCONEL 713LC
INCONEL 718
INCONEL 738
STAINLESS STEEL-316
Emission Spectra
Application of heavy-ion-induced x-ray satellite emission to alloys, 9:50149 (J;GB)
Structural Chemical Analysis
Structural studies of amorphous Mo-Ge alloys using synchrotron radiation, 9:50110 (R;US)
Thermal Stresses
710 reactor program. Progress report No. 17, 9:49784 (R;US)
Thermodynamic Properties
Thermodynamic properties of gamma-uranium in the formation of solid solutions with alpha-transition metals, 9:50150 (TG;US)
X-Ray Spectra
Application of heavy-ion-induced x-ray satellite emission to alloys, 9:50149 (J;GB)
MOLYBDENUM BORIDES
Thermionic Emission
Thermionic emission and vaporization behavior of the ternary systems of lanthanum hexaboride containing molybdenum boride, molybdenum diboride, zirconium diboride, gadolinium hexaboride, and neodymium hexaboride, 9:50168 (J;US)
MOLYBDENUM SILICIDES
Fabrication
Fabrication of SiC whiskers and composites, 9:50174 (R;US)
MOLYBDENUM SULFIDES
Friction
Frictional and morphological properties of Au-MoS2 films sputtered from a compact target, 9:50204 (R;US)
Microstructure
Frictional and morphological properties of Au-MoS2 films sputtered from a compact target, 9:50204 (R;US)
MONITORED RETRIEVABLE STORAGE
Safeguards
Safeguards and security design guidelines for conceptual monitored retrievable storage (MRS) facilities, 9:49571 (R;US)
Security
Safeguards and security design guidelines for conceptual monitored retrievable storage (MRS) facilities, 9:49571 (R;US)
MONITORING (RADIATION)
See RADIATION MONITORING
MONITORS (REACTOR)
See REACTOR CONTROL SYSTEMS
MONOCRYSTALS
See also WHISKERS
Charged-Particle Transport
Radiation at particle scattering in ultrathin crystals, 9:50952 (RA;SU;In Russian)
MONTANA
Geologic Structures
Compound structural history of Sweetgrass arch, northwestern Montana, 9:50662 (J;US)
Orogenesis
Laramide interactions of structural elements in southwestern Montana, 9:50663 (J;US)
MORDENITE
Performance Testing
Development of process for combined NO/sub x//SO/sub x/ control. Technical progress report, September 1984, 9:49400 (R;US)
MORIN
Fluorescence
Concerning the question of the fluorescence yield of solutions, 9:50328 (TJ;US)
MORTALITY
Radioinduction
Limited life-table factors for estimating radiation-induced cancers over finite time periods, 9:50619 (J;GB)
MOSFET
Metal Oxide Silicon Field Effect Transistors.
The effects of selectively absorbing dielectric layers and beam shaping on recrystallization and FET characteristics in laser recrystallized silicon on amorphous substrates, 9:50227 (BA;NL)
Fabrication
Beam processing of silicon with a scanning CW Hg lamp, 9:50236 (BA;NL)
Electrical characteristics and device applications of zone-melting-recrystallized Si films on SiO_2, 9:50231 (BA;NL)
Selective laser annealing for device processing, 9:50235 (BA;NL)
MULTILAMELLAR LIPID VESICLES
See LIPOSOMES
MULTIPARTICLE SPECTROMETERS
Maintenance
BNL multiparticle spectrometer software, 9:50457 (R;US)
MULTIPLETS
Lie Groups
Multiplet classification of the reducible elementary representations of real semisimple Lie groups, 9:50793 (RA;BG;In Bulgarian)
MUNICIPAL BUILDINGS
See PUBLIC BUILDINGS
MUNICIPAL WASTES
Anaerobic Digestion
Size distribution of airborne particulate matter emitted by the front-end processing of municipal solid waste feed material for large-scale anaerobic digesters, 9:49581 (J;US)
MUONS
Pions and muons - beyond exotic atoms, 9:50731 (RA;AU)
MUSCLES
Atrophy
Muscle atrophy and restoration during molting, 9:50600 (R;US)
Role of calcium-dependent proteinase in molt-induced claw muscle atrophy, 9:50601 (R;US)
MUSCULAR TISSUE
See MUSCLES
TISSUES
MUTAGENESIS
Reviews
Control of mutagenesis and cell differentiation in cultured human and rodent cells by chemicals that initiate or promote tumor formation, 9:50632 (R;US)
MX DEVICES
See MFTF DEVICES

N

NAL SYNCHROTRON
See FERMILAB ACCELERATOR
NASA
Technology Transfer
Nonaerospace uses of JPL technology: a report on technology transfer, 9:51045 (R;US)
NATIONAL ACCELERATOR LABORATORY
See FERMILAB ACCELERATOR
NATIONAL AERONAUTICS AND SPACE ADMINISTRA
See NASA
NATIONAL ENERGY SECURITY CORPORATION
See SYNTHETIC FUELS CORPORATION
NATIONAL REACTOR TESTING STATION BURST FA
See PBF REACTOR
NATURAL GAS
See also LIQUEFIED NATURAL GAS
Chemical Analysis
Downhole sampling of geopressured gas wells. Final report, June 1982-July 1984, 9:49477 (R;US)

Cost
Transport costs and the spatial distribution of natural gas prices, 9:49479 (R;US)
Distribution
Natural gas monthly, July 1984, 9:49478 (R;US)
Energy Supplies
Natural gas monthly, July 1984, 9:49478 (R;US)
Prices
How rapidly can production and use of eastern coal be expanded (USA; 1973-1982), 9:49411 (RA;US)
Natural gas price increases in Los Angeles, 9:49480 (R;US)
Proposed changes to natural gas laws (Part 5). Hearings before the Subcommittee on Fossil and Synthetic Fuels of the Committee on Energy and Commerce, House of Representatives, Ninety-Eighth Congress, First Session, 9:49484 (B;US)
Prospects for coal in America's energy future (USA: 1982 to 2000), 9:49413 (R;US)
State Energy Price System: 1982 update, 9:49952 (R;US)
Production
Stratigraphically controlled gas production from Abo red beds (Permian), east-central New Mexico, 9:49475 (R;US)
Reserves
Outer Continental Shelf oil and gas activities in the Gulf of Alaska and their onshore impacts. Gulf of Alaska summary report update, May 1984, 9:49449 (R;US)
Transplants
Defect detection by acoustic emission. Part 1, 9:49487 (J;US)
Transport
Defect detection by acoustic emission. Part 2, 9:49486 (J;US)
Transport costs and the spatial distribution of natural gas prices, 9:49479 (R;US)

NATURAL GAS DEPOSITS
See also NATURAL GAS FIELDS
Exploration
Outer Continental Shelf oil and gas activities in the Gulf of Alaska and their onshore impacts. Gulf of Alaska summary report update, May 1984, 9:49449 (R;US)
Geochemistry
Eastern gas shales subprogram (Appalachia, Illinois and Michigan Basins), 9:49474 (R;US)
Geology
Eastern gas shales subprogram (Appalachia, Illinois and Michigan Basins), 9:49474 (R;US)
Land Leasing
Outer Continental Shelf oil and gas activities in the Gulf of Alaska and their onshore impacts. Gulf of Alaska summary report update, May 1984, 9:49449 (R;US)
Leasing
Analysis of changes introduced under the proposed OCS leasing schedule, 9:49456 (R;US)
Petroleum Deposits
Identification of changes introduced under the proposed OCS leasing schedule, 9:49467 (R;US)
Resource Assessment
Eastern gas shales subprogram (Appalachia, Illinois and Michigan Basins), 9:49474 (R;US)
Experiment to evaluate methods for estimating fossil fuel resources, 9:49444 (R;US)
Resource Development
Consistency: current issues, 9:49468 (R;US)
Stratigraphy
Stratigraphically controlled gas production from Abo red beds (Permian), east-central New Mexico, 9:49475 (R;US)

NATURAL GAS DISTRIBUTION SYSTEMS
Fuel Cells
Study of pipeline applications of fuel cells. Final report, 9:49961 (R;US)
Pipelines
Alaska Natural Gas Transportation System, 9:49485 (R;US)

NATURAL GAS FIELDS
Exploration
Annual report 1981 (The Norwegian Petroleum Directorate), 9:49443 (R;NO)

NATURAL GAS GATHERING SYSTEMS
See NATURAL GAS DISTRIBUTION SYSTEMS

NATURAL GAS INDUSTRY
Financial Incentives
Post-war energy economics: the urban and regional implications, 9:49921 (RA;US)
Regulations
Proposed changes to natural gas laws (Part 5). Hearings before the Subcommittee on Fossil and Synthetic Fuels of the Committee on Energy and Commerce, House of Representatives, Ninety-Eighth Congress, First Session, 9:49484 (B;US)

NATURAL GAS WELLS
Directional Drilling
Feasibility study: vertical fracturing in directionally drilled wells. Final report, January 1983-September 1983, 9:49482 (R;US)
Environmental Impacts
Subsidence monitoring in conjunction with methane gas production in Louisiana (phase 1, deep well program). Annual report November 1981-January 1983, 9:49481 (R;US)
Fluid Injection
Apparatus for recovering gaseous hydrocarbons from hydrocarbon-containing solid hydrates, 9:49483 (P;US)
Fracturing
Stratigraphically controlled gas production from Abo red beds (Permian), east-central New Mexico, 9:49475 (R;US)
Hydraulic Fracturing
Feasibility study: vertical fracturing in directionally drilled wells. Final report, January 1983-September 1983, 9:49482 (R;US)
Production
Annual report 1981 (The Norwegian Petroleum Directorate), 9:49443 (R;NO)
Samplers
Downhole sampling of geopressured gas wells. Final report, June 1982-July 1984, 9:49477 (R;US)
Well Completion
Eastern gas shales subprogram, 9:49474 (R;US)
Well Drilling
Stratigraphically controlled gas production from Abo red beds (Permian), east-central New Mexico, 9:49475 (R;US)
Well Stimulation
Eastern gas shales subprogram, 9:49474 (R;US)

NATURAL LIGHTING
See DAYLIGHTING

NATURAL URANIUM
Radioecological Concentration
Uranium content in surface air in Vienna during the years 1963/64 and 1974 - 1978, 9:50541 (R;AT;In German)

NATURE RESERVES
Air Quality
Copper smelters and atmospheric visibility in the southwest, seasonal analysis, 9:50534 (J;US)

NAVAL PETROLEUM RESERVE
Evaluation
Naval Petroleum Reserve No. 1: an assessment of production alternatives, 9:49951 (R;US)
Productivity
Naval Petroleum Reserve No. 1: an assessment of production alternatives, 9:49951 (R;US)

NEGATONS
See ELECTRONS

NEGATRONS
See ELECTRONS

NEODYMIUM BORIDES
Thermionic Emission
Thermionic emission and vaporization behavior of the ternary systems of lanthanum hexaboride containing molybdenum boride, molybdenum diboride, zirconium diboride, gadolinium hexaboride, and neodymium hexaboride, 9:50168 (J;US)

NEODYMIUM LASERS
Tuning
Tunable optical sources. Final report 20 February 1981-19 February 1984, 9:50388 (R;US)

NEON
Collisions
Observation of single phonon scattering of Ne^{20}-atoms from a LiF (001) surface, 9:50749 (R;AT)
NEON 20 TARGET
Electron Reactions
Analyses of electron and proton scattering to low excitation isoscalar states in ^{20}Ne, ^{24}Mg and ^{28}Si, 9:50856 (R;AU)
Oxygen 16 Reactions
Coupled channels description of resonant structures in the $^{16}O + ^{20}Ne$ system, 9:50849 (RA;AU)
Resonant structures in the $^{20}Ne(^{16}O,^{12}C)^{24}Mg$ reaction, 9:50850 (RA;AU)
Proton Reactions
Analyses of electron and proton scattering to low excitation isoscalar states in ^{20}Ne, ^{24}Mg and ^{28}Si, 9:50856 (R;AU)
NEOPENTANE
See 2-2-DIMETHYLPROPANE
NEOPLASMS
See also ADENOMAS
HEPATOMAS
MELANOMAS
Radioinduction
Limited life-table factors for estimating radiation-induced cancers over finite time periods, 9:50619 (J;GB)
Toxicology of ^{85}Kr: chronic exposure studies, 9:50620 (J;GB)
Risk Assessment
Computer code for general analysis of radon risks (GARR), 9:50615 (R;US)
NEPTUNIUM 237
Biological Radiation Effects
Neptunium revisited, 9:50625 (J;US)
Radionuclide Kinetics
Neptunium revisited, 9:50625 (J;US)
NEPTUNIUM 237 TARGET
Neutron Reactions
Isomer ratio calculations using modeled discrete levels, 9:50893 (R;US)
NEPTUNIUM ALLOYS
Neutron Diffraction
Neutron diffraction study of the tetragonal $NpCu_4Al_8$ and $ErFe_4Al_8$ intermetallic compounds, 9:50114 (RA;IL)
NERVES
Autoradiography
Mathematical model to determine incorporated quantities of radioactivity from the measured photometric values of tritium-autoradiographs in neuroanatomy, 9:50592 (R;DE;In German)
NETHERLANDS
Radiation Protection
Radioactive materials decree and the radiation apparatus decree in the nuclear energy law, 9:49931 (RA;NL;In Dutch)
NETWORKS (COMPUTER)
See COMPUTER NETWORKS
NEUTRAL ATOM BEAM INJECTION
Neutral beam current drive in TFTR, 9:51017 (RA;GB)
Optimization of tokamak reactors with beam-driven current, 9:51014 (RA;GB)
Review of current drive by fast ion injection, 9:50982 (RA;GB)
NEUTRINO DETECTION
Heavy Liquid Bubble Chambers
Experimental neutrino physics at Serpukhov, 9:50768 (RA;BG)
NEUTRINO REACTIONS
Measuring Methods
The contribution of cosmogenic radioisotopes to solar neutrino flux measurements, 9:50709 (J;US)
NEUTRINOS
See also SOLAR NEUTRINOS
TAU NEUTRINOS
Weak Particle Decay
Cosmological constraints on heavy neutrino lifetimes, 9:50782 (RA;AU)
NEUTRON ACTIVATION ANALYSIS
See ACTIVATION ANALYSIS
NEUTRON REACTIONS
NEUTRON CAMERAS
Data Processing
Fast parallel encoding scheme for the Anger camera, 9:50491 (BA;GB)
NEUTRON CAPTURE
See NEUTRON REACTIONS
NEUTRON DETECTION
Position Sensitive Detectors
Data processing in neutron protein crystallography using position-sensitive detectors, 9:50492 (BA;GB)
Recent developments in position-sensitive neutron counting, 9:50490 (BA;GB)
Spatial resolution of neutron-position scintillation detectors, 9:50488 (BA;GB)
Summary of position-sensitive detector workshop Institut Laue-Langevin, Grenoble, France 11-12 October 1982, 9:50493 (BA;GB)
NEUTRON DIFFRACTOMETERS
Computer Calculations
Optimization of flat and horizontally curved neutron monochromators for given diffractometer geometries, 9:50928 (R;DE)
Monochromators
Optimization of flat and horizontally curved neutron monochromators for given diffractometer geometries, 9:50928 (R;DE)
NEUTRON MATTER
See NUCLEAR MATTER
NEUTRON REACTIONS
Analyzing Power
Comparison of neutron-deuteron and proton-deuteron analysing powers, 9:50831 (RA;AU)
Capture
Analysis of n + ^{197}Au cross sections for E/sub n/ = 0.01-20 MeV, 9:50902 (R;US)
Isomer ratio calculations using modeled discrete levels, 9:50893 (R;US)
Proton induced reactions on ^{37}Cl and their relevance to nucleosynthesis, 9:50853 (RA;AU)
Cross Sections
Applied nuclear data research and development. Semiannual progress report, April 1-September 30, 1983, 9:50824 (R;US)
Evaluation of neutron nuclear data for ^{12}C, 9:50844 (R;XN)
Neutron nuclear data of ^{9}Be adopted in JENDL-2, 9:50846 (R;JP)
Neutron nuclear data of ^{7}Li adopted in JENDL-2, 9:50845 (R;JP)
Fission
Measurement of subthreshold fission cross section in $^{230}Th(n,f)$, 9:50904 (RA;AU)
Glauber Theory
Medium energy probes and the IBM, 9:50915 (R;US)
Inelastic Scattering
Analysis of n + ^{197}Au cross sections for E/sub n/ = 0.01-20 MeV, 9:50902 (R;US)
Interacting Boson Model
Medium energy probes and the IBM, 9:50915 (R;US)
Multiple Scattering
Medium energy probes and the IBM, 9:50915 (R;US)
Quasi-Elastic Scattering
Isomer ratio calculations using modeled discrete levels, 9:50893 (R;US)
NEUTRON SOURCES
Excludes reactors even when used as neutron sources.
Data Compilation
Transuranium Processing Plant report of production, status, and plans for October 1, 1980-March 31, 1983, 9:50350 (R;US)
Targets
Tritium/deuterium gas cell, 9:50465 (R;US)
NEUTRON STARS
Star Evolution
Neutron star cooling: effects of envelope physics, 9:50712 (BA;NL)

Star Models
Neutron star cooling: effects of envelope physics, 9:50712 (BA;NL)

NEUTRON-DEFICIENT ISOTOPES
Alpha Decay
Studies of extremely neutron-deficient isotopes near the proton shell Z = 82, 9:50882 (R;DE;In German)
Internal Conversion
Studies of extremely neutron-deficient isotopes near the proton shell Z = 82, 9:50882 (R;DE;In German)

NEUTRONS
Carcinogenesis
Radiation research report, 9:50604 (R;US)
Electric Charges
Electroneutrality of the neutron, 9:50769 (RA;BG;In Bulgarian)

NEVADA
Geothermal Industry
Geothermal energy development in Nevada's Great Basin. Hearing before the Subcommittee on Energy and Mineral Resources of the Committee on Energy and Natural Resources, United States Senate, Ninety-Eighth Congress, Second Session, April 17, 1984, 9:49728 (B;US)
Geothermal Resources
Geothermal energy development in Nevada's Great Basin. Hearing before the Subcommittee on Energy and Mineral Resources of the Committee on Energy and Natural Resources, United States Senate, Ninety-Eighth Congress, Second Session, April 17, 1984, 9:49728 (B;US)

NEW MEXICO
Natural Gas Deposits
Stratigraphically controlled gas production from Abo red beds (Permian), east-central New Mexico, 9:49475 (R;US)
Remedial Action
Remedial action at the Acid/Pueblo Canyon site, Los Alamos, New Mexico. Final report, 9:49567 (R;US)

NEW YORK
Radioactive Waste Facilities
Directions in low-level radioactive waste management. Low-level radioactive waste disposal: commercial facilities no longer operating, 9:49544 (R;US)

NEW ZEALAND
Research Programs
Regional study of land suitability and potential availability for energy farming. Phase I report, 9:49622 (R;NZ)

NICKEL
Catalytic Effects
Catalysts for gasification of biomass, 9:49586 (R;US)
Energy
Embedded-atom method: Derivation and application to impurities, surfaces, and other defects in metals, 9:50143 (J;US)
Fracture Mechanics
Embedded-atom method: Derivation and application to impurities, surfaces, and other defects in metals, 9:50143 (J;US)
Grain Boundaries
Atomistic studies of grain boundaries with segregated impurities. Final progress report, July 1983-June 30, 1984, 9:50108 (R;US)
Nitrogen 14 Reactions
Near-threshold production of neutral π mesons in heavy-ion reactions, 9:50848 (R;US)
Physical Radiation Effects
Structural transformations in nickel films bombarded by phosphorus and neon ions, 9:50128 (RA;SU;In Russian)
Soil Chemistry
Attenuation of chemical elements in acidic leachates from coal mineral wastes by soils, 9:49407 (R;US)
Surface Properties
Embedded-atom method: Derivation and application to impurities, surfaces, and other defects in metals, 9:50143 (J;US)

NICKEL 58 TARGET
Proton Reactions
$^{58}Ni(p,\gamma)^{59}Cu$ cross section and its importance for nucleosynthesis and statistical model studies, 9:50859 (RA;AU)

NICKEL 60 TARGET
Pion Minus Reactions
Dependence of the excitation energy, width, and cross section of the isovector monopole resonance, 9:50878 (J;FR)
Pion Plus Reactions
Dependence of the excitation energy, width, and cross section of the isovector monopole resonance, 9:50878 (J;FR)
Pion Reactions
Excitation of giant resonances in pion charge-exchange reactions, 9:50879 (J;FR)

NICKEL ALLOYS
See also NICKEL BASE ALLOYS
NICKEL STEELS
Fabrication
Design of ordered intermetallic alloys for high-temperature structural use (Ni_3V-CO_3V-Fe_3V; Ni_3Al), 9:50096 (R;US)
Grain Growth
Investigation of the growth kinetics of metal carbide systems (WC-Co; TiC-Co; TiC-Ni), 9:50170 (TJ;US)
Mechanical Properties
Design of ordered intermetallic alloys for high-temperature structural use (Ni_3V-CO_3V-Fe_3V; Ni_3Al), 9:50096 (R;US)
Physical Radiation Effects
Amorphous phase formation in irradiated intermetallic compounds (Ni-Ti; Ni-Al; Fe-Ti; Fe-Al; Re-Ta), 9:50138 (R;US)

NICKEL BASE ALLOYS
See also ALLOY-IN-100
ALLOY-IN-939
Mechanical Properties
Role of boron additions on grain-boundary chemistry and tensile properties of Ni_3Al containing 24 and 26 at. % Al, 9:50106 (R;US)
Neutron Diffraction
Neutron diffraction experiments on amorphous alloys, 9:50131 (R;HU)
Oxidation
Oxidation-sulfidation behavior of materials in coal-conversion environments, 9:50152 (J;JP)
Physical Radiation Effects
Radiation-induced compositional redistribution and local phase transformation in irradiated alloys, 9:50101 (R;US)
Sulfidation
Oxidation-sulfidation behavior of materials in coal-conversion environments, 9:50152 (J;JP)

NICKEL IONS
Transmission
Anomalous mean free paths for scattering of convoy electrons generated by fast, highly ionized ions in thin solid targets, 9:50725 (R;US)

NICKEL STEELS
Forging
Evaluation of the weldability of heavy-section forgings with special emphasis of segregated areas, 9:50122 (RA;DE;In German)
Manufacturing of ultra-large diameter 20 MnMoNi 5 5 steel forgings for reactor pressure vessels and their properties, 9:50116 (RA;DE)
Fracture Properties
Significance of the state of segregation of the carbide phase on the toughness properties of 20 MnMoNi 5 5 forgings, 9:50119 (RA;DE;In German)
Tempering
Significance of the state of segregation of the carbide phase on the toughness properties of 20 MnMoNi 5 5 forgings, 9:50119 (RA;DE;In German)
Welding
Evaluation of the weldability of heavy-section forgings with special emphasis of segregated areas, 9:50122 (RA;DE;In German)

NICKEL-CADMIUM BATTERIES
Electric Conductivity
Contribution to the description of the electrical behaviour of lead, nickel-cadmium, and nickel-iron accumulators, 9:49914 (R;DE;In German)
Electrolytes
Rapid electrolyte exchange procedures for 22 AH Nickel-Cadmium Celgard cells, 9:49911 (R;CA)
NICKEL-IRON BATTERIES
See IRON-NICKEL BATTERIES
NIM
See NUCLEAR INSTRUMENT MODULES
NIOBATES
Specific compounds should be indexed by coordination of a descriptor in the form (CATION) COMPOUNDS and the above anion descriptor.
Phonons
Phonon properties of $LaNbO_4$ deduced from heat-capacity measurements, 9:50185 (R;US)
Specific Heat
Phonon properties of $LaNbO_4$ deduced from heat-capacity measurements, 9:50185 (R;US)
NIOBIUM
Ion Implantation
Energy-dispersion X-ray analysis for investigation of structural transformations in crystals at ion implantation, 9:50126 (RA;SU;In Russian)
Physical Radiation Effects
Energy-dispersion X-ray analysis for investigation of structural transformations in crystals at ion implantation, 9:50126 (RA;SU;In Russian)
Surface Properties
Surface studies of Nb, its compounds, and coatings, 9:50140 (R;US)
NIOBIUM ALLOYS
See also ALLOY-IN-939
INCONEL 713LC
INCONEL 718
NIOBIUM BASE ALLOYS
Fracture Properties
Boron-induced toughness loss in Ti-6A1-2Nb-1Ta-0.8Mo, 9:50107 (R;US)
Neutron Diffraction
Neutron diffraction experiments on amorphous alloys, 9:50131 (R;HU)
Superconductivity
Critical current density of bronze-processed multifilamentary Nb_3Sn wires with magnesium addition to the matrix, 9:50141 (J;US)
Thermodynamic Properties
Thermodynamic properties of gamma-uranium in the formation of solid solutions with alpha-transition metals, 9:50150 (TG;US)
NIOBIUM BASE ALLOYS
Chemical Composition
Isothermal equilibrium pressures of a Y-Nb alloy-H_2 system, 9:50310 (J;CH)
Critical Current
Effect of Ta additions upon in situ prepared Nb_3 Sn-Cu superconducting wire, 9:50386 (J;US)
Critical Field
Effect of Ta additions upon in situ prepared Nb_3 Sn-Cu superconducting wire, 9:50386 (J;US)
NIOBIUM COMPOUNDS
See also NIOBATES
NIOBIUM NITRIDES
NIOBIUM SELENIDES
Surface Properties
Surface studies of Nb, its compounds, and coatings, 9:50140 (R;US)
NIOBIUM NITRIDES
Epitaxy
Superconducting electronic film structures. Annual report 1 January-31 December 1983, 9:50360 (R;US)
Superconductivity
Superconducting electronic film structures. Annual report 1 January-31 December 1983, 9:50360 (R;US)
NIOBIUM SELENIDES
Plasma Waves
Josephson-type oscillations in a moving charge-density wave interacting with magnetic impurities, 9:50212 (J;US)
NITRATES
See also PEROXYACETYL NITRATE
PLUTONIUM NITRATES
Fluctuations
Temporal and spatial variability of phytoplankton in a subtropical ecosystem, 9:50565 (J;US)
NITRIC OXIDE
NO.
Excitation
Multiphoton ionization photoelectron spectroscopy: xenon and nitric oxide, 9:50340 (J;NL)
NITRIDES
See also NIOBIUM NITRIDES
SILICON NITRIDES
Chemical Preparation
Synthesis of refractory materials, 9:50165 (P;US)
NITROGEN
Ecological Concentration
Uptake rate of nitrogen dioxide by potato plants, 9:50639 (J;US)
Foliar Uptake
Uptake rate of nitrogen dioxide by potato plants, 9:50639 (J;US)
Nuclear Reaction Analysis
Measurement of lean body mass in animals by thermal neutron capture gamma-ray analysis, 9:50280 (RA;AU)
Raman Spectroscopy
Ignition probing by laser techniques. Preliminary experiments, 9:50077 (R;SE)
Removal
Alternative modes of processing SRC in an expanded-bed LC-finer to produce low-nitrogen distillates, 9:49372 (J;US)
NITROGEN 14 REACTIONS
Fusion Reactions
Localized l window from partial fusion reactions accompanied by proton, deuteron, and triton emission, 9:50887 (RA;AU)
Partial fusion reaction and its application to high-spin spectroscopy, 9:50890 (RA;AU)
Particle Production
Near-threshold production of neutral π mesons in heavy-ion reactions, 9:50848 (R;US)
NITROGEN 14 TARGET
Photonuclear Reactions
Photoneutron cross section for ^{12}C, ^{14}N and ^{16}O, 9:50840 (RA;AU)
NITROGEN 16
Energy Levels
Interaction of ^{7}Li with ^{16}O at 50 MeV, 9:50839 (RA;AU)
Location of 3p-3h strength in ^{16}N via the reaction $^{13}C(\alpha,p)^{16}N$ at 118 MeV, 9:50842 (RA;AU)
Stripping
Location of 3p-3h strength in ^{16}N via the reaction $^{13}C(\alpha,p)^{16}N$ at 118 MeV, 9:50842 (RA;AU)
NITROGEN COMPOUNDS
See also AZIDES
HYDRAZINE
NITRATES
NITRIDES
NITROGEN OXIDES
Biological Accumulation
Impact of Lupinus leucophyllous on the nitrogen budgets of semi-arid plant communities, 9:50550 (R;US)
Quantitative Chemical Analysis
Nitrogen compound distribution in Eastern and Western U.S. shale oils produced by hydropyrolysis, 9:49503 (BA;US)
Structural Chemical Analysis
Nitrogen compound distribution in Eastern and Western U.S. shale oils produced by hydropyrolysis, 9:49503 (BA;US)
NITROGEN DIOXIDE
NO_2.
Fluorescence
Time-resolved fluorescence spectra of rotationally cooled NO2, 9:50754 (J;GB)

Standards
National air quality and emission trends report, 1982, 9:50531 (R;US)
NITROGEN NITRIDES
See NITROGEN
NITROGEN OXIDES
See also NITRIC OXIDE
NITROGEN DIOXIDE
Air Pollution Control
Application of reburning for NO(x) control to a firetube package boiler. Report for April 1983-March 1984, 9:50434 (R;US)
SO/sub x//NO/sub x/ control, 9:49752 (RA;US)
Atmospheric Chemistry
Direct formation of NO_2 in combustion products, 9:50538 (J;NL)
Monitoring
Health and environmental monitoring at the University of Minnesota-Duluth coal gasification facility. Draft, 9:49404 (R;US)
Reduction
Development of process for combined NO/sub x//SO/sub x/ control. Technical progress report, September 1984, 9:49400 (R;US)
2-NITROINIDAZOLE
See MISONIDAZOLE
NITROSAMINES
Carcinogen Screening
Mutagenic activity of nitrosamines in mammalian cells: Study with the CHO/HGPRT and human leukocyte SCE assays, 9:50642 (BA;US)
Carcinogenesis
The relationship between the carcinogenicity and mutagenicity of nitrosamines in a hepatocytemediated mutagenicity assay, 9:50643 (BA;US)
Mutagen Screening
Mutagenic activity of nitrosamines in mammalian cells: Study with the CHO/HGPRT and human leukocyte SCE assays, 9:50642 (BA;US)
Structural basis for mutagenic activity of N-nitrosamines in the Salmonella histidine reversion assay, 9:50645 (BA;US)
The relationship between the carcinogenicity and mutagenicity of nitrosamines in a hepatocytemediated mutagenicity assay, 9:50643 (BA;US)
NITROSO COMPOUNDS
See also CHLORINS
NITROSAMINES
Mutagenesis
Effects of pH and structure on the mutagenic activity of N-nitroso compounds, 9:50644 (BA;US)
NMR
See NUCLEAR MAGNETIC RESONANCE
NMR SPECTRA
Standards
Method of preparing $(CH_3)_3SiNSO$ and byproducts thereof, 9:50292 (P;US)
NOBELIUM
Alpha Decay
Calculated masses and half-lives for nuclei in the region $100 \leqq Z \leqq 110$, 9:50905 (R;US)
Mass
Calculated masses and half-lives for nuclei in the region $100 \leqq Z \leqq 110$, 9:50905 (R;US)
Spontaneous Fission
Calculated masses and half-lives for nuclei in the region $100 \leqq Z \leqq 110$, 9:50905 (R;US)
NONRADIOACTIVE WASTES
See SOLID WASTES
NORBORNADIENE
Isomerization
Wavelength effects on ionic photodissociation of charge-transfer complexes: the quadricyclene system, 9:50343 (J;NL)
Structural Chemical Analysis
Wavelength effects on ionic photodissociation of charge-transfer complexes: the quadricyclene system, 9:50343 (J;NL)
NORTH AMERICA
See also CANADA
MEXICO
USA
Oil Shale Deposits
A tectonic-climatic approach to the deposition of the Devonian-Mississippian black-shale sequence of North America, 9:49493 (BA;US)
NORTH SEA
Atmospheric Pressure
Ekofisk E-data. Data report: Jan-Jun 1982 (Environmental data from the Ekofisk field in the North Sea), 9:50515 (R;NO)
Statfjord E-data. Data report: Jan-Dec 1982 (Environmental data from the Statfjord field in the North Sea), 9:50516 (R;NO)
Statfjord E-data. Data report: Jan-Dec 1981 (Environmental data from the Statfjord field in the North Sea), 9:50517 (R;NO)
Climates
Ekofisk E-data. Data report: Jan-Jun 1982 (Environmental data from the Ekofisk field in the North Sea), 9:50515 (R;NO)
Statfjord E-data. Data report: Jan-Dec 1982 (Environmental data from the Statfjord field in the North Sea), 9:50516 (R;NO)
Statfjord E-data. Data report: Jan-Dec 1981 (Environmental data from the Statfjord field in the North Sea), 9:50517 (R;NO)
Meteorology
Ekofisk E-data. Data report: Jan-Jun 1982 (Environmental data from the Ekofisk field in the North Sea), 9:50515 (R;NO)
Statfjord E-data. Data report: Jan-Dec 1982 (Environmental data from the Statfjord field in the North Sea), 9:50516 (R;NO)
Statfjord E-data. Data report: Jan-Dec 1981 (Environmental data from the Statfjord field in the North Sea), 9:50517 (R;NO)
Natural Gas Deposits
Annual report 1981 (The Norwegian Petroleum Directorate), 9:49443 (R;NO)
Petroleum Deposits
Annual report 1981 (The Norwegian Petroleum Directorate), 9:49443 (R;NO)
Petroleum Geology
Annual report 1981 (The Norwegian Petroleum Directorate), 9:49443 (R;NO)
Safety
Risk for collisions with oil and gas installations on the Norwegian continental shelf. Collection and preparation of data. Part report No. 3. Reported infringements of safety zones around Norwegian offshore installations, 9:49453 (R;NO)
Water Currents
Ekofisk E-data. Data report: Jan-Jun 1982 (Environmental data from the Ekofisk field in the North Sea), 9:50515 (R;NO)
Water Waves
Directional wave spectra from the Frigg Field in the North Sea, 9:50581 (R;NO)
Wind
Ekofisk E-data. Data report: Jan-Jun 1982 (Environmental data from the Ekofisk field in the North Sea), 9:50515 (R;NO)
Statfjord E-data. Data report: Jan-Dec 1982 (Environmental data from the Statfjord field in the North Sea), 9:50516 (R;NO)
Statfjord E-data. Data report: Jan-Dec 1981 (Environmental data from the Statfjord field in the North Sea), 9:50517 (R;NO)
NORWAY
Continental Shelf
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Natural Gas Deposits
Annual report 1981 (The Norwegian Petroleum Directorate), 9:49443 (R;NO)
Offshore Drilling
Annual report 1981 (The Norwegian Petroleum Directorate), 9:49443 (R;NO)
Petroleum Deposits
Annual report 1981 (The Norwegian Petroleum Directorate), 9:49443 (R;NO)
Petroleum Industry
Annual report 1981 (The Norwegian Petroleum Directorate), 9:49443 (R;NO)
NOS. 4, 5, AND 6 FUEL OILS
See RESIDUAL FUELS
NOS. 5 AND 6 BURNER OILS
See RESIDUAL FUELS
NOZZLES
Fabrication
Accuracy of X-ray lithography using synchrotron radiation for the fabrication of technical separation nozzle elements, 9:49511 (R;DE;In German)
NUCLEAR ATTACKS
See NUCLEAR WEAPONS
NUCLEAR CASCADES
Cherenkov Radiation
Monte Carlo simulation of electron/photon/Cherenkov cascades in generalized geometry, 9:50934 (J;US)
NUCLEAR CHEMISTRY
Research Programs
Nuclear chemistry progress report, 9:50821 (R;US)
NUCLEAR CONTROVERSY
See HUMAN POPULATIONS
NUCLEAR DATA COLLECTIONS
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NUCLEAR FACILITIES
See also FEED MATERIALS PLANTS
FUEL REPROCESSING PLANTS
ISOTOPE SEPARATION PLANTS
NUCLEAR POWER PLANTS
RADIOACTIVE WASTE FACILITIES
Emergency Plans
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NUCLEAR FUEL ELEMENTS
See FUEL ELEMENTS
NUCLEAR FUELS
See also SPENT FUELS
Performance
GT2R2: an updated version of GAPCON-THERMAL-2, 9:49816 (R;US)
Reactivity
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NUCLEAR INDUSTRY
Reactor Safety
Engineer-constructor's view of nuclear power plant safety, 9:49876 (RA;DE)
NUCLEAR INSTRUMENT MODULES
Analog-to-Digital Converters
Medium speed computer interface (digitizer) for general purpose data acquisition, 9:50503 (R;US)
NUCLEAR MAGNETIC RESONANCE
Superconducting Coils
Role of superconducting magnets in NMR medical imaging, 9:50596 (J;FR)
NUCLEAR MATTER
Collective Model
Collective, stochastic and nonequilibrium behavior of highly excited hadronic matter, 9:50920 (J;NL)
Entropy
Volume corrections for the specific entropy in nucleon-deuteron mixtures, 9:50914 (R;HU)
Irreversible Processes
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Stochastic Processes
Collective, stochastic and nonequilibrium behavior of highly excited hadronic matter, 9:50920 (J;NL)
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Use only for indexing articles of very broad coverage, such as annual reviews, text books, etc.
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Research Programs
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NUCLEAR POWER
Financial Incentives
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Public Relations
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NUCLEAR POWER PLANTS
Availability
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Comparative Evaluations
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Construction
Status of Bonneville Power Administration's efforts to improve its oversight of three nuclear power projects, 9:49792 (R;US)
Cost
Technical reference book for the Energy Economic Data Base (EEDB) Program, 9:49791 (R;US)
Economics
Civilian uses of nuclear power: status and future, 9:49790 (RA;US)
Technical reference book for the Energy Economic Data Base (EEDB) Program, 9:49791 (R;US)

Electrical Equipment
Environmental qualification of certain electric equipment important to safety for nuclear power plants. Rev. 1, 9:49788 (R;US)
Emergency Plans
Further actions needed to improve emergency preparedness around nuclear powerplants, 9:49855 (R;US)
Energy Policy
Civilian uses of nuclear power: status and future, 9:49790 (RA;US)
In-Service Inspection
Requirements for diagnostic measurement in pressurized water reactor nuclear power plants, 9:49822 (RA;CS;In Czech)
Maintenance
Recording and evaluation of maintenance and repair jobs in nuclear power plants, 9:49811 (RA;CS;In Slovak)
On-Line Control Systems
Computers in experimental nuclear power facilities, 9:49835 (RA;CS;In Czech)
Performance
1982 analyses and reports: equipment availability report; component cause code report; and equipment availability report, 9:49744 (R;US)
Power Generation
1982 analyses and reports: equipment availability report; component cause code report; and equipment availability report, 9:49744 (R;US)
Quality Assurance
Manual on quality assurance programme auditing, 9:49789 (R;AT)
Radiation Protection
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Reactor Operation
CONTING Program Guide, 9:49765 (R;US)
Regulatory Guides
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Seismic Effects
SSI sensitivity studies and model improvements for the US NRC Seismic Safety Margins Research Program. Rev. 1, 9:49902 (R;US)
Simulation
Nuclear Plant Analyzer: an interactive TRAC/RELAP Power-Plant Simulation Program, 9:49886 (R;US)
Turbogenerators
Laboratory measurements of subsynchronous resonance, 9:49762 (R;ZA)
Water Treatment
Method for treatment of wastewater of nuclear power plants, 9:49832 (TG;US)

NUCLEAR POWER STATIONS
See NUCLEAR POWER PLANTS

NUCLEAR PROPERTIES
Reviews
Properties of heavy-ion produced nuclei far from stability, 9:50870 (R;DE)

NUCLEAR REACTION ANALYSIS
Nuclear reaction analysis profiling, 9:50281 (RA;AU)
Mathematics
Selected topics in surface analysis by high-energy ion beams, 9:50287 (RA;AU)

NUCLEAR REACTORS
See REACTORS

NUCLEAR SAFETY
See RADIATION PROTECTION

NUCLEAR SPIN RESONANCE
See NUCLEAR MAGNETIC RESONANCE

NUCLEAR STRUCTURE
Oscillations
Oscillatory structure of the harmonic oscillator Wigner function, 9:50923 (J;GB)
Research Programs
Triangle Universities Nuclear Laboratory annual report, TUNL XXIII, September 1, 1983-June 30, 1984, 9:50820 (R;US)

NUCLEAR WASTES
See RADIOACTIVE WASTES

NUCLEAR WEAPON TESTS
See NUCLEAR EXPLOSIONS

NUCLEAR WEAPONS
Allocations
BRIK, an interactive, goal programming model for nuclear exchange problems. Master's thesis, 9:50508 (R;US)
Computerized Simulation
Investigation of optimal aimpoints for multiple nuclear weapons against installations in a target complex. Master's thesis, 9:50507 (R;US)
Environment
Concept for operations in a nuclear environment. Technical report, 9:50509 (R;US)
Mathematical Models
BRIK, an interactive, goal programming model for nuclear exchange problems. Master's thesis, 9:50508 (R;US)
Warfare
Concept for operations in a nuclear environment. Technical report, 9:50509 (R;US)

NUCLEI
See also COSMIC NUCLEI
EVEN-EVEN NUCLEI
INTERMEDIATE MASS NUCLEI
LIGHT NUCLEI
MAGIC NUCLEI
Pion Reactions
Capture of pions by nuclei, 9:50912 (RA;SU;In Russian)

NUCLEON-NUCLEON INTERACTIONS
Boson-Exchange Models
Meson-exchange Hamiltonian for nucleon-nucleon scattering up to 2 GeV, 9:50791 (BA;NL)

NUCLEON-NUCLEON POTENTIAL
Wave Functions
Parity admixtures in the nucleon wavefunction, 9:50906 (RA;AU)

NUCLEONS
See also NEUTRONS
PROTONS
Decay
Nonstandard fermion mass matrices and nucleon decay, 9:50789 (J;US)

NUTRIENTS
Mineral Cycling
Forest nutrient cycles as affected by climate, species composition, stand age, and intensive harvesting, 9:49605 (R;US)

O

OAK RIDGE RESEARCH REACTOR
See ORR REACTOR

OCCUPATIONAL SAFETY
Monitoring
Instrumentation for occupational health research, 9:50494 (R;US)

OCEAN CURRENTS
See WATER CURRENTS

OCEAN THERMAL POWER PLANTS
Closed-Cycle Systems
OTEC pilot plant for Kahe Point, Hawaii, 9:49680 (BA;US)
Design
OTEC pilot plant for Kahe Point, Hawaii, 9:49680 (BA;US)
Test Facilities
Design of the near shore seawater systems for an OTEC expanded test facility, 9:49681 (BA;US)
Water Supply
Design of the near shore seawater systems for an OTEC expanded test facility, 9:49681 (BA;US)

OCEANS
See SEAS

OFF-GAS SYSTEMS
Off-gas treatment and characterization for a radioactive in situ vitrification test, 9:49556 (R;US)
OFFICE BUILDINGS
Energy Consumption
Model of commercial energy use in Greater Auckland, 9:50004 (R;NZ)
Lighting Systems
Uplighting design guide, 9:50007 (R;GB)
Mathematical Models
Model of commercial energy use in Greater Auckland, 9:50004 (R;NZ)
Solar Space Heating
Solar energy system case study: Telex Communications, Blue Earth, Minnesota, 9:49691 (R;US)
OFFSHORE DRILLING
Control Equipment
High reliability instrumentation systems (Subsea control system for monitoring well heads), 9:50436 (R;NO;In Norwegian)
OFFSHORE OPERATIONS
Regulations
Risk for collisions with oil and gas installations on the Norwegian continental shelf. Collection and preparation of data. Part report No. 3. Reported infringements of safety zones around Norwegian offshore installations, 9:49453 (R;NO)
OFFSHORE PLATFORMS
Includes gravity or fixed, floating, and towed platforms.
Accidents
Risk for collisions with oil and gas installations on the Norwegian continental shelf. Collection and preparation of data. Part report No. 3. Reported infringements of safety zones around Norwegian offshore installations, 9:49453 (R;NO)
Environment
Ekofisk E-data. Data report: Jan-Jun 1982 (Environmental data from the Ekofisk field in the North Sea), 9:50515 (R;NO)
Statfjord E-data. Data report: Jan-Dec 1982 (Environmental data from the Statfjord field in the North Sea), 9:50516 (R;NO)
Statfjord E-data. Data report: Jan-Dec 1981 (Environmental data from the Statfjord field in the North Sea), 9:50517 (R;NO)
Safety
Annual report 1981 (The Norwegian Petroleum Directorate), 9:49443 (R;NO)
Risk for collisions with oil and gas installations on the Norwegian continental shelf. Collection and preparation of data. Part report No. 3. Reported infringements of safety zones around Norwegian offshore installations, 9:49453 (R;NO)
OHIO
Oil Shale Deposits
The Ohio oil shale core study, Shawnee No.1, Scioto County, Ohio, 9:49491 (BA;US)
OHMIC PLASMA LOSSES
See ENERGY LOSSES
OIL BURNERS
Efficiency
Combustion efficiency optimization manual for operators of oil- and gas-fired boilers. Final report, 9:50433 (R;US)
Manuals
Combustion efficiency optimization manual for operators of oil- and gas-fired boilers. Final report, 9:50433 (R;US)
Operation
Combustion efficiency optimization manual for operators of oil- and gas-fired boilers. Final report, 9:50433 (R;US)
OIL FIELDS
Exploration
Annual report 1981 (The Norwegian Petroleum Directorate), 9:49443 (R;NO)
OIL SANDS
Gas Injection
Design of a field experiment for air-steam co-injection for oil recovery in a Utah tar sand, 9:49500 (J;US)
Solid Wastes
Assessment of research and development for the management of fossil energy-related solid wastes, 9:49399 (R;US)
Steam Injection
Design of a field experiment for air-steam co-injection for oil recovery in a Utah tar sand, 9:49500 (J;US)
OIL SHALE DEPOSITS
Geology
A tectonic-climatic approach to the deposition of the Devonian-Mississippian black-shale sequence of North America, 9:49493 (BA;US)
Geophysical Surveys
The Ohio oil shale core study, Shawnee No.1, Scioto County, Ohio, 9:49491 (BA;US)
Tectonics
A tectonic-climatic approach to the deposition of the Devonian-Mississippian black-shale sequence of North America, 9:49493 (BA;US)
OIL SHALE INDUSTRY
Financial Incentives
Review and evaluation of costs and benefits from various oil shale strategies. Final report, 9:49504 (R;US)
Production
Review and evaluation of costs and benefits from various oil shale strategies. Final report, 9:49504 (R;US)
OIL SHALE MINING
Engineering Geology
The geology and geochemistry of Devonian Shales in South and West Central Kentucky, 9:49492 (BA;US)
Water Pollution Control
Characterization of oil shale mine waters, central Piceance Basin, Colorado. Final report, 9:49505 (R;US)
OIL SHALE PROCESSING PLANTS
Waste Disposal
The reactivity of pyrite in raw eastern oil shale and its transformation during processing, 9:49506 (BA;US)
OIL SHALE WASTE WATER
See OIL SHALES
WASTE WATER
OIL SHALES
See also BLACK SHALES
Dielectric Properties
Dielectric properties of oil shale materials, 9:49501 (BA;US)
Fluidized-Bed Combustion
Combined fluidized bed retort and combustor, 9:49497 (P;US)
Fluidization 1980 conference: [summary of workshop discussions], 9:49426 (R;US)
Geochemistry
Geochemistry of Mississippian and Devonian oil shales of northeastern Kentucky, 9:49494 (J;US)
Hytort Process
Nitrogen compound distribution in Eastern and Western U.S. shale oils produced by hydropyrolysis, 9:49503 (BA;US)
In-Situ Retorting
Investigation of tracer tests on the Western Research Institute 10-ton retort, 9:49496 (R;US)
Retorting
Battelle's Multi-Solid Fluidized Bed Oil Shale Retort, 9:49498 (BA;US)
Combined fluidized bed retort and combustor, 9:49497 (P;US)
Solid Wastes
Assessment of research and development for the management of fossil energy-related solid wastes, 9:49399 (R;US)
OIL SPILL FINGERPRINTING
See OIL SPILLS
PATTERN RECOGNITION
OIL SPILLS
Biological Effects
Report to the Shetland Oil Terminal Environmental Advisory Group on the Shetland Beached Bird Survey, March 1982-February 1983, 9:49464 (R;GB)
Report to the Shetland Oil Terminal Environmental Advisory Group on the Beached Bird Survey in Shetland, March 1980-February 1982, with a review of results since July 1978, 9:49465 (R;GB)

Environmental Effects
Report to SOTEAG (Shetland Oil Terminal Environmental Advisory Group) on numbers of Tysties ('Cepphus grylle') in the area of the Yell Sound Islands, September 1982, 9:49463 (R;GB)
OIL WELLS
Carbon Dioxide Injection
Enhanced oil recovery by CO_2 foam flooding. Quarterly report, July 1-September 30, 1984, 9:49448 (R;US)
Gas Injection
Gas injection in heterogeneous reservoirs. Analytical solution No. 1, 9:49450 (R;NO)
Gas injection in heterogeneous reservoirs. Case study No. 1, 9:49451 (R;NO)
Microemulsion Flooding
Project evaluation: Penn Grade Micellar Displacement Project, 9:49446 (R;US)
Results of the Bell Creek Unit "A" micellar-polymer pilot, 9:49452 (J;US)
Production
Annual report 1981 (The Norwegian Petroleum Directorate), 9:49443 (R;NO)
Waterflooding
Improved polymers for enhanced oil recovery synthesis and rheology. Sixth annual report, October 1982-September 1983, 9:49447 (R;US)
ONCOGENIC TRANSFORMATIONS
Radioinduction
Effects of cellular non-protein sulfhydryl depletion in radiation induced oncogenic transformation and genotoxicity in mouse C_3H 10T1/2 cells, 9:50616 (J;US)
Paraquat and radiation effects on mouse C_3H 10T1/2 cells, 9:50617 (J;US)
ON-LINE COMPUTERS
See COMPUTERS
ON-LINE MEASUREMENT SYSTEMS
Design
Sonic resonator control and method for determining component concentration in multiple component molten liquids, 9:50146 (P;US)
Resonators
Sonic resonator control and method for determining component concentration in multiple component molten liquids, 9:50146 (P;US)
OPEC
Organization of Petroleum Exporting Countries
Energy Models
Model of the world oil market with an OPEC cartel, 9:49461 (R;US)
OPEN PLASMA DEVICES
Energy Losses
Effect of radial transport on tandem mirror end loss, 9:51012 (J;GB)
OPERATORS(QUANTUM FIELD THEORY)
See QUANTUM OPERATORS
OPERATORS(QUANTUM MECHANICAL)
See QUANTUM OPERATORS
OPTICAL EQUIPMENT
Machining
Survey of the finish characteristics of machined optical surfaces, 9:50365 (R;US)
Surveys
Survey of the finish characteristics of machined optical surfaces, 9:50365 (R;US)
OPTICAL RADAR
Uses
Signal averaging limitations in heterodyne- and direct-detection laser remote sensing measurements, 9:50518 (BA;NL)
ORGAN CULTURES
See TISSUE CULTURES
ORGANIC COMPOUNDS
See also AMINES
AROMATICS
HYDROCARBONS
ORGANIC POLYMERS
PROTEINS
Phase Studies
Sour water stripping of coal gasification waste water. Final report, 9:49386 (R;US)
Removal
Sour water stripping of coal gasification waste water. Final report, 9:49386 (R;US)
ORGANIC POLYMERS
See also POLYAMIDES
RESINS
RUBBERS
Electroplating
Electroless metal plating of plastics, 9:50179 (P;US)
Production
New polymer electrodes and conductors based on poly(hydroquinone/quinone) oxidation/reduction systems. Technical progress report, 9:50176 (R;US)
Research Programs
Improved polymers for enhanced oil recovery synthesis and rheology. Sixth annual report, October 1982-September 1983, 9:49447 (R;US)
Structural Chemical Analysis
Improved polymers for enhanced oil recovery synthesis and rheology. Sixth annual report, October 1982-September 1983, 9:49447 (R;US)
Synthesis
Improved polymers for enhanced oil recovery synthesis and rheology. Sixth annual report, October 1982-September 1983, 9:49447 (R;US)
Viscosity
Improved polymers for enhanced oil recovery synthesis and rheology. Sixth annual report, October 1982-September 1983, 9:49447 (R;US)
ORGANIC SOLVENTS
Comparative Evaluations
Advanced research for the characterization of hydrogen donor solvents in two-stage liquefaction. Quarterly report, April 1, 1984-June 30, 1984, 9:49356 (R;US)
Hydrogenation
Advanced research for the characterization of hydrogen donor solvents in two-stage liquefaction. Quarterly report, April 1, 1984-June 30, 1984, 9:49356 (R;US)
Synthesis
Solvent fermentations of pulp streams and their constituents, 9:50316 (R;US)
ORNL RESEARCH REACTOR
See ORR REACTOR
ORNL-PCA REACTOR
Reactor Operation
Bulk Shielding Facility. Quarterly report, January-March 1984, 9:49838 (R;US)
OROGENESIS
Geologic Faults
Laramide interactions of structural elements in southwestern Montana, 9:50663 (J;US)
Sediments
Laramide interactions of structural elements in southwestern Montana, 9:50663 (J;US)
ORR REACTOR
ORNL evaluation of the ORR-PSF metallurgical experiment and blind test, 9:49833 (R;US)
OSCILLATIONS (PLASMA)
See PLASMA WAVES
OSCILLATORS (REACTOR)
See REACTOR OSCILLATORS
OSMIUM 188
Energy Levels
Variations of the gyromagnetic ratios of corresponding states in $^{188\ 190\ 192}$Os - measurements and interpretations, 9:50889 (RA;AU)
OSMIUM 190
Energy Levels
Variations of the gyromagnetic ratios of corresponding states in $^{188\ 190\ 192}$Os - measurements and interpretations, 9:50889 (RA;AU)

OSMIUM 192
Energy Levels
Variations of the gyromagnetic ratios of corresponding states in $^{188\ 190\ 192}$Os - measurements and interpretations, 9:50889 (RA;AU)
OSMIUM ISOTOPES
See also OSMIUM 188
OSMIUM 190
OSMIUM 192
High Spin States
Bose-fermi U(6/2j+1) supersymmetries and high spin anomalies, 9:50903 (R;AU)
Interacting Boson Model
Bose-fermi U(6/2j+1) supersymmetries and high spin anomalies, 9:50903 (R;AU)
OSTEOSARCOMAS
Radioinduction
Plutonium-induced wounds in beagles, 9:50621 (J;GB)
OUTER CONTINENTAL SHELF
See CONTINENTAL SHELF
OXIDES
See also ALUMINIUM OXIDES
AMERICIUM OXIDES
CALCIUM OXIDES
COPPER OXIDES
NITROGEN OXIDES
PLUTONIUM OXIDES
SILICON OXIDES
SULFUR OXIDES
THORIUM OXIDES
ZINC OXIDES
Removal
Method for removing oxide contamination from titanium diboride powder, 9:50166 (P;US)
OXYGEN
Chemical Reaction Kinetics
Reactive scattering of O(^{3}P) with toluene, 9:50321 (J;US)
Production
Method for producing hydrogen and oxygen by use of algae, 9:49576 (P;US)
OXYGEN 16 REACTIONS
Alpha-Transfer Reactions
Resonant structures in the ^{20}Ne(^{16}O,^{12}C)^{24}Mg reaction, 9:50850 (RA;AU)
Coupled Channel Born Approximation
Coupled channels description of resonant structures in the ^{16}O + ^{20}Ne system, 9:50849 (RA;AU)
Elastic Scattering
Coupled channels description of resonant structures in the ^{16}O + ^{20}Ne system, 9:50849 (RA;AU)
Parity-dependence of the nucleus-nucleus potential and ^{16}O + ^{24}Mg elastic scattering at theta sub(c.m.)=90°, 9:50852 (RA;AU)
Inelastic Scattering
Heavy ion excitation and photon decay of giant resonances, 9:50880 (J;FR)
Scattering
Direct reaction analysis of heavy ion collision from the quasi-elastic to the deep-inelastic regime, 9:50857 (RA;AU)
OXYGEN 16 TARGET
Lithium 7 Reactions
Interaction of ^{7}Li with ^{16}O at 50 MeV, 9:50839 (RA;AU)
Photonuclear Reactions
Photoneutron cross section for ^{12}C, ^{14}N and ^{16}O, 9:50840 (RA;AU)
OXYGEN 17
Isotopic Exchange
Kinetics of oxygen exchange between bisulfite ion and water as studied by oxygen-17 nuclear magnetic resonance spectroscopy, 9:50302 (R;US)
OXYGEN 17 REACTIONS
Inelastic Scattering
Heavy ion excitation and photon decay of giant resonances, 9:50880 (J;FR)
OXYGEN 17 TARGET
Photonuclear Reactions
^{17}O(γ,p) cross section, 9:50843 (RA;AU)
OXYGEN 18
Giant Resonance
Chaos near the Coulomb barrier. Nuclear molecules, 9:50833 (R;US)
OXYGEN 18 REACTIONS
Transfer Reactions
Masses and level schemes of very neutron-rich nuclei with A approximately 30, 9:50851 (RA;AU)
OXYGEN COMPOUNDS
See also NIOBATES
NITRATES
OXIDES
PHOSPHATES
SILICATES
SULFATES
WATER
Chemical Reaction Kinetics
Theoretical study of the reaction of AlF^-_b and $AlCl^-_4$ with oxide and sulfide ions, 9:50314 (J;US)
OXYGEN EFFECT (RADIOBIOLOGY)
See OXYGEN
OXYGEN HYDRIDES
See WATER
OXYGEN IONS
Ion-Atom Collisions
Forward electron production in heavy ion-atom and ion-solid collisions, 9:50723 (R;US)
OZONE
Biological Effects
Comparative ozone dose response of gas exchange in a ponderosa pine stand exposed to long-term fumigations, 9:50648 (J;US)
Standards
National air quality and emission trends report, 1982, 9:50531 (R;US)

P

PACIFIC NORTHWEST REGION
See FEDERAL REGION X
PACKED BED
Mass Transfer
Modeling of solid-side mass transfer in desiccant particle beds, 9:49700 (BA;US)
Mathematical Models
Modeling of solid-side mass transfer in desiccant particle beds, 9:49700 (BA;US)
Thermal Conductivity
Effective thermal conductivity in packed beds of spheres especially in the core of a high temperature reactor, 9:49780 (R;DE;In German)
PAH
See POLYCYCLIC AROMATIC HYDROCARBONS
PAINTS
Chemical Analysis
Energy dispersive X-ray elemental analysis for pigments identification of tempera painting, 9:50270 (RA;BG;In Bulgarian)
PAKISTAN ATOMIC RESEARCH REACTOR
See PARR REACTOR
PALLADIUM
Energy
Embedded-atom method: Derivation and application to impurities, surfaces, and other defects in metals, 9:50143 (J;US)
Fracture Mechanics
Embedded-atom method: Derivation and application to impurities, surfaces, and other defects in metals, 9:50143 (J;US)
Surface Properties
Embedded-atom method: Derivation and application to impurities, surfaces, and other defects in metals, 9:50143 (J;US)

PALLADIUM ALLOYS
Electric Conductivity
Resistivity of alloys, 9:50946 (R;US)
Thermodynamic Properties
Thermodynamic properties of gamma-uranium in the formation of solid solutions with alpha-transition metals, 9:50150 (TG;US)
PALLADIUM HYDRIDES
Physical Properties
Properties and thermal stabilities of amorphous transition metal hydrides (Zr_2PdH; Zr_3RhH), 9:50163 (R;US)
PALO DURO BASIN
Climates
Consideration of future climatic changes in three geologic settings, 9:49554 (R;US)
Salt Deposits
Summary of petrographic and chemical data for Palo Duro Basin samples examined by Bendix Field Engineering Corporation, Grand Junction, Colorado, as of April 29, 1983, 9:49538 (R;US)
PARABOLIC DISH COLLECTORS
Systems Analysis
Nomographic methodology for use in performance trade-off studies of parabolic dish solar power modules, 9:49664 (R;US)
PARABOLIC DISH REFLECTORS
Wind Loads
Wind loading on solar concentrators: some general considerations, 9:49663 (R;US)
PARABOLIC POINT COLLECTORS
See PARABOLIC DISH COLLECTORS
PARABOLIC REFLECTORS
See also PARABOLIC DISH REFLECTORS
Testing
Sandia concentrator array testing experiences, 9:49717 (BA;US)
PARABOLIC TROUGH COLLECTORS
Black Liquids
High efficiency parabolic solar collector with glass pipe and black fluid, 9:49704 (R;US)
Thermal Efficiency
High efficiency parabolic solar collector with glass pipe and black fluid, 9:49704 (R;US)
PARAMAGNETIC RESONANCE (NUCLEAR)
See NUCLEAR MAGNETIC RESONANCE
PARR REACTOR
Control Rod Drives
Mathematical formulation of temperature fluctuation and control rod vibration in PARR, 9:49839 (R;PK)
Temperature Noise
Mathematical formulation of temperature fluctuation and control rod vibration in PARR, 9:49839 (R;PK)
PARTICLE DECAY
Selection Rules
Gauge invariance and selection rules for elementary particles, 9:50794 (RA;BG;In Russian)
PARTICLE SIZE CLASSIFIERS
Configuration
Zigzag configurations and air classifier performance, 9:50430 (J;US)
Performance Testing
Zigzag configurations and air classifier performance, 9:50430 (J;US)
PARTICLE TRACKS
Studies of charged-particle tracks in liquid water, 9:50926 (R;US)
Computerized Simulation
RACETRACK - a computer code for the simulation of nonlinear particle motion in accelerators, 9:50452 (R;DE)
PARTICLE-HOLE MODEL
Particle-hole description of the nuclear giant dipole resonance in light-to-medium nuclei, 9:50907 (RA;AU)
PARTICLES
When appropriate use more specific terms listed under CHARGED PARTICLES, ELEMENTARY PARTICLES, and QUASI PARTICLES.
See also DROPLETS
PARTICULATES
Combustion
Combustion research and ash fouling, 9:49428 (RA;US)
PARTICULATES
Prior to September 1981, this concept was indexed to PARTICLES and AEROSOLS.
Adsorption
Alkali removal from hot combustion gases by adsorption on submicron-size particles, 9:49393 (RA;US)
Air Pollution Control
SO/sub x//NO/sub x/ control, 9:49752 (RA;US)
Particle Size
Size distribution of airborne particulate matter emitted by the front-end processing of municipal solid waste feed material for large-scale anaerobic digesters, 9:49581 (J;US)
Removal
Dust filtration using ceramic fiber filter media: a state-of-the-art summary, 9:49395 (RA;US)
High-temperature moving bed granular filter development at Combustion Power Company, 9:49390 (RA;US)
High-temperature removal of alkali vapors in hot-gas cleaning systems, 9:49343 (RA;US)
Hot gas cleanup using porous ceramic cross flow filters, 9:49394 (RA;US)
Testing and verification of granular bed filters for removal of particulates and alkalis, 9:49389 (RA;US)
PASSIVE SOLAR HEATING SYSTEMS
See also DIRECT GAIN SYSTEMS
Passive solar homes (Glossary), 9:49702 (B;US)
Technology Impacts
Assessment of how residential passive solar systems impact utilities. Final report, 9:49686 (R;US)
PATIENTS
Delayed Radiation Effects
Current (1984) status of the study of ^{226}Ra and ^{228}Ra in humans at the Center for Human Radiobiology, 9:50608 (R;US)
PATTERN RECOGNITION
Computer Codes
CONTING Program Guide, 9:49765 (R;US)
PBF REACTOR
Reactor Accidents
Raman and luminescence spectroscopy of zirconium oxide with the use of the MOLE microprobe, 9:49854 (R;US)
PCA-ORNL REACTOR
See ORNL-PCA REACTOR
PEAT
Solid Wastes
Assessment of research and development for the management of fossil energy-related solid wastes, 9:49399 (R;US)
PEBBLE BED REACTORS
See also AVR REACTOR
Reactor Physics
Installation of a three-dimensional simulation method for core-physical description of pebble bed reactors with multiple recycling process at the example of the AVR, 9:49800 (R;DE;In German)
PELLETS (FUEL)
See FUEL PELLETS
PENNING ION SOURCES
Reviews
State and development of ion sources for accelerators, 9:50466 (R;DD;In German)
RF Systems
Effect of resonant microwave power on a PIG ion source, 9:50743 (R;US)
Technology Assessment
State and development of ion sources for accelerators, 9:50466 (R;DD;In German)
PENTANE
Chemical Reactions
Reactions of $FeCH_3i$ and $CoCH_3^+$ with aliphatic alkanes in the gas phase, 9:50322 (J;US)
Isomerization
Kinetics - studies I. Model experiments with dehydrogenation of propane and isomerization of pentane, 9:50319 (R;NO;In Norwegian)

PEOPLE
See HUMAN POPULATIONS
PERIODIC SYSTEM
Structure of the periodic system, 9:50750 (R;AT)
PERIOSTEUM
See BONE TISSUES
PEROXYACETYL NITRATE
Decomposition
Peroxyacetyl nitrate solubility and decomposition rate in acidic water, 9:50574 (J;GB)
Solubility
Peroxyacetyl nitrate solubility and decomposition rate in acidic water, 9:50574 (J;GB)
PERSONNEL
Studies of groups of persons employed in a particular field of endeavor. For studies on individuals in a group see also MAN.
See also DIAL PAINTERS
Biological Radiation Effects
Studies of plutonium workers, 9:50622 (J;US)
Contamination
Report of an accidental acute human exposure to ^{241}Am, 9:50624 (J;US)
Radiation Doses
Spent fuel test - Climax: technical measurements. Interim report, Fiscal Year 1983, 9:49560 (R;US)
Studies of plutonium workers, 9:50622 (J;US)
PETROLEUM
Limited to crude oil; see also COAL LIQUIDS, SHALE OIL, etc.
See also PETROLEUM FRACTIONS
Biological Effects
Petroleum effects on neural systems in marine organisms. Progress report, 1 August 1979-14 April 1980, 9:50634 (R;US)
Consumption Rates
Energy: challenges and opportunities for the Middle Atlantic United States. Volume 1. Summaries and discussions, 9:49945 (R;US)
Data Compilation
Petroleum supply monthly, July 1984, 9:49454 (R;US)
Economic Analysis
Has the energy crisis passed (1973 to about 2000; US, OPEC and global aspects), 9:49946 (RA;US)
Market
Model of the world oil market with an OPEC cartel (1980 AD to 2040 AD), 9:49461 (R;US)
Prices
Energy: challenges and opportunities for the Middle Atlantic United States. Volume 1. Summaries and discussions, 9:49945 (R;US)
Has the energy crisis passed (1973 to about 2000; US, OPEC and global aspects), 9:49946 (RA;US)
How rapidly can production and use of eastern coal be expanded (USA; 1973-1982), 9:49411 (RA;US)
Model of the world oil market with an OPEC cartel (1980 AD to 2040 AD), 9:49461 (R;US)
Prospects for coal in America's energy future (USA: 1982 to 2000), 9:49413 (R;US)
Production
Project evaluation: Penn Grade Micellar Displacement Project, 9:49446 (R;US)
Reserves
Outer Continental Shelf oil and gas activities in the Gulf of Alaska and their onshore impacts. Gulf of Alaska summary report update, May 1984, 9:49449 (R;US)
Stockpiles
Risk aversion and the insurance value of strategic oil stockpiling, 9:49458 (R;US)
Strategic oil stocks and public-private interactions: a dynamic game analysis, 9:49457 (R;US)
Supply and Demand
Has the energy crisis passed (1973 to about 2000; US, OPEC and global aspects), 9:49946 (RA;US)
Supply Disruption
Geographic variation in fuel flexibility: implications for the regional incidence of oil supply disruptions, 9:49460 (R;US)
Oil supply disruptions and the role of the International Energy Agency, 9:49459 (R;US)
PETROLEUM COKE
See COKE
PETROLEUM PRODUCTS
PETROLEUM DEPOSITS
See also NAVAL PETROLEUM RESERVE
OIL FIELDS
Exploration
Outer Continental Shelf oil and gas activities in the Gulf of Alaska and their onshore impacts. Gulf of Alaska summary report update, May 1984, 9:49449 (R;US)
Land Leasing
Outer Continental Shelf oil and gas activities in the Gulf of Alaska and their onshore impacts. Gulf of Alaska summary report update, May 1984, 9:49449 (R;US)
Leasing
Analysis of changes introduced under the proposed OCS leasing schedule, 9:49456 (R;US)
Identification of changes introduced under the proposed OCS leasing schedule, 9:49467 (R;US)
Resource Assessment
Experiment to evaluate methods for estimating fossil fuel resources, 9:49444 (R;US)
Resource Development
Consistency: current issues, 9:49468 (R;US)
PETROLEUM DISTILLATES
Boiling point range 0-600°C.
Data Compilation
Petroleum supply monthly, July 1984, 9:49454 (R;US)
PETROLEUM FRACTIONS
See also PETROLEUM DISTILLATES
Carcinogen Screening
Mutagenicity and carcinogenicity of polycyclic aromatic enriched fractions from coal liquefaction materials, 9:50637 (R;US)
Mutagen Screening
Mutagenicity and carcinogenicity of polycyclic aromatic enriched fractions from coal liquefaction materials, 9:50637 (R;US)
PETROLEUM INDUSTRY
Environmental Effects
Air quality monitoring at Sullom Voe using lichens as biological indicator species: results of the 1981 and 1982 repeat photographic surveys, 9:49466 (R;GB)
Financial Incentives
Post-war energy economics: the urban and regional implications, 9:49921 (RA;US)
Review and evaluation of costs and benefits from various oil shale strategies. Final report, 9:49504 (R;US)
Government Policies
Annual report 1981 (The Norwegian Petroleum Directorate), 9:49443 (R;NO)
Production
Review and evaluation of costs and benefits from various oil shale strategies. Final report, 9:49504 (R;US)
PETROLEUM PRODUCTS
See also DIESEL FUELS
FUEL OILS
GASOLINE
KEROSENE
LIQUEFIED PETROLEUM GASES
Data Compilation
Petroleum supply monthly, July 1984, 9:49454 (R;US)
Sales
Petroleum marketing monthly, July 1984, 9:49455 (R;US)
PHASE CHANGE MATERIALS
Use with the specific phase change material (e.g. calcium chloride) when known.
Commercialization
Industrial work on latent heat storage, 9:49718 (R;US)
Research Programs
Advanced latent heat storage media for high-temperature industrial applications, 9:49907 (R;US)

PHASE SHIFT
Crossing Symmetry
P_{11} channel and the effects of crossing symmetry, 9:50797 (RA;AU)
PHASE STUDIES
Equilibrium
Phase equilibria in aluminium-lithium-magnesium alloys at 200°C, 300°C and 400°C and their hardening in a casting state, 9:50134 (R;DE;In German)
PHENOL
Removal
Zinc ferrite hydrogen sulfide absorbent, 9:49340 (RA;US)
PHENYL ETHER
Chemical Reaction Kinetics
Structure of decomposing $[C_7H_7O]^+$ ions: benzyl versus tropylium ion structures, 9:50338 (J;GB)
Decomposition
Structure of decomposing $[C_7H_7O]^+$ ions: benzyl versus tropylium ion structures, 9:50338 (J;GB)
Isomerization
Structure of decomposing $[C_7H_7O]^+$ ions: benzyl versus tropylium ion structures, 9:50338 (J;GB)
Structural Chemical Analysis
Structure of decomposing $[C_7H_7O]^+$ ions: benzyl versus tropylium ion structures, 9:50338 (J;GB)
PHOSPHATE GLASS
Chemical Properties
Chemically durable nitrogen containing phosphate glasses useful for sealing to metals, 9:50211 (P;US)
Stability
Chemically durable nitrogen containing phosphate glasses useful for sealing to metals, 9:50211 (P;US)
PHOSPHATES
For salts only; see also PHOSPHORIC ACID ESTERS.
See also POTASSIUM PHOSPHATES
SODIUM PHOSPHATES
Chemical Analysis
Constant-current potentiometric titration of orthophosphate with cetylpyridinium chloride: a feasibility study, 9:50295 (J;GB)
Fluctuations
Temporal and spatial variability of phytoplankton in a subtropical ecosystem, 9:50565 (J;US)
Potentiometry
Kitchensink titrations, 9:50303 (R;US)
PHOSPHORIC ACID
Chemical Reactions
Method for incorporating radioactive phosphoric acid solutions in concrete, 9:50216 (P;US)
PHOSPHORUS
Potentiometry
Constant-current potentiometric titration of orthophosphate with cetylpyridinium chloride: a feasibility study, 9:50295 (J;GB)
Proton Microprobe Analysis
Elemental microanalysis of individual blood cells, 9:50277 (RA;AU)
PHOTOACOUSTIC SPECTROSCOPY
Uses
Photoacoustic spectroscopy at electrode-solution interface, 9:50329 (R;US)
PHOTODIODES
Production
Growth and properties of semiconductor strained-layer superlattices, 9:50186 (R;US)
PHOTODISINTEGRATION
See PHOTONUCLEAR REACTIONS
PHOTOELECTROCHEMICAL CELLS
Design
Photoelectrochemical cells for conversion of solar energy to electricity and methods of their manufacture, 9:49630 (P;US)
Efficiency
n-$CuInSe_2$ based photoelectrochemical cells: Improved, stable performance in aqueous polyiodide through rational surface and solution modifications, 9:49628 (J;US)
Fabrication
Photoelectrochemical cells for conversion of solar energy to electricity and methods of their manufacture, 9:49630 (P;US)
Performance
n-$CuInSe_2$ based photoelectrochemical cells: Improved, stable performance in aqueous polyiodide through rational surface and solution modifications, 9:49628 (J;US)
Stability
n-$CuInSe_2$ based photoelectrochemical cells: Improved, stable performance in aqueous polyiodide through rational surface and solution modifications, 9:49628 (J;US)
PHOTOELECTRON SPECTROSCOPY
Electrostatic Analyzers
Calculation and computer simulation of the Paraboloidal Mirror Analyzer (PMA), 9:50746 (R;US)
Synchrotron Radiation
Electron spectrometry experiments with the use of synchrotron radiation, 9:50722 (R;US)
PHOTOIONIZATION
Multi-Photon Processes
Effects of dc electric fields on multiphoton ionization spectra in cesium, 9:50726 (R;US)
PHOTOMAGNETOELECTRIC EFFECT
See MAGNETIC FIELDS
PHOTON ACTIVATION ANALYSIS
See ACTIVATION ANALYSIS
PHOTONS
PHOTON DETECTION (GAMMA)
See GAMMA DETECTION
PHOTON TRANSPORT
Computerized Simulation
Monte Carlo simulation of electron/photon/Cherenkov cascades in generalized geometry, 9:50934 (J;US)
PHOTON-ELECTRON INTERACTIONS
Deep Inelastic Scattering
Measurement of the photon structure function $F_2sup(\gamma)(x,Q^2)$, 9:50767 (R;DE)
PHOTON-PHOTON INTERACTIONS
Total Cross Sections
Total cross sections for two off shell photons, 9:50777 (R;DE)
PHOTONS
See also COSMIC PHOTONS
Structure Functions
Measurement of the photon structure function $F_2sup(\gamma)(x,Q^2)$, 9:50767 (R;DE)
PHOTONUCLEAR REACTIONS
Photonuclear reactions in light nuclei, 9:50830 (RA;AU)
Breakup Reactions
Theoretical calculation of the forward cross section for deuteron photodisintegration at low energies, 9:50829 (RA;AU)
Cross Sections
Photoneutron reaction cross sections of ^{121}Sb, ^{123}Sb and Nat.Sb, 9:50875 (RA;AU)
Elastic Scattering
Elastic scattering of γ-rays at small scattering angles, 9:50873 (RA;AU)
Integral Cross Sections
Photoneutron cross section for ^{13}C, ^{14}N and ^{16}O, 9:50840 (RA;AU)
Knock-Out Reactions
$^{48}Ca(\gamma,n+p)$ photonuclear cross section in the giant dipole resonance region, 9:50861 (RA;AU)
$^{17}O(\gamma,p)$ cross section, 9:50843 (RA;AU)
Photoneutron cross sections of ^{121}Sb, ^{123}Sb and sup(nat) Sb, 9:50877 (R;AU)
Photoproduction
Measurement of coherent π^0 photoproduction on ^3He and ^3H in the resonance region, 9:50828 (R;DE)
PHOTOVOLTAIC CELLS
See also SOLAR CELLS
Adhesion
Chemical bonding technology for terrestrial photovoltaic modules, 9:49619 (R;US)
Electrical Faults
Empirical testing of an analytical model predicting electrical isolation of photovoltaic models, 9:49640 (BA;US)

PHOTOVOLTAIC POWER PLANTS
Availability
Reliability, availability and maintenance-costs models for use in the design of photovoltaic power systems, 9:49658 (BA;US)
Cost Benefit Analysis
Cost analyses of modular flat-panel and concentrator photovoltaic array fields, 9:49659 (BA;US)
Design
Design and installation experiences from nine intermediate-sized photovoltaic systems: a critical analysis, 9:49660 (BA;US)
Installation
Design and installation experiences from nine intermediate-sized photovoltaic systems: a critical analysis, 9:49660 (BA;US)
Maintenance
Reliability, availability and maintenance-costs models for use in the design of photovoltaic power systems, 9:49658 (BA;US)
Research Programs
Utility interface issues for grid-connected photovoltaic systems, 9:49657 (BA;US)
Technology Assessment
Photovoltaic power conditioning subsystem: state of the art and development opportunities, 9:49654 (R;US)
PHOTOVOLTAIC POWER SUPPLIES
Energy on an independent farm. Final performance report, 9:49734 (R;US)
Computerized Simulation
Photovoltaic-electrolyzer system transient simulation results, 9:49656 (BA;US)
Simulated performance of the Texas Instruments Solar Energy System in various U.S. cities, 9:49655 (BA;US)
Electrolysis
Simulated performance of the Texas Instruments Solar Energy System in various U.S. cities, 9:49655 (BA;US)
Hydrogen Fuel Cells
Simulated performance of the Texas Instruments Solar Energy System in various U.S. cities, 9:49655 (BA;US)
Performance
Progress at the Southwest Residential Experiment Station, 9:49661 (BA;US)
Simulated performance of the Texas Instruments Solar Energy System in various U.S. cities, 9:49655 (BA;US)
Photoelectrolysis
Photovoltaic-electrolyzer system transient simulation results, 9:49656 (BA;US)
Systems Analysis
Photovoltaic-electrolyzer system transient simulation results, 9:49656 (BA;US)
Tax Credits
Effects of expiration of the federal energy tax credit on the National Photovoltaics Program, 9:49602 (R;US)
Transients
Photovoltaic-electrolyzer system transient simulation results, 9:49656 (BA;US)
Uses
Signal Hill solar-powered repeater report and recommendations, 9:49653 (R;US)
PHYSICS
See also HIGH ENERGY PHYSICS
NUCLEAR PHYSICS
REACTOR PHYSICS
Meetings
First national congress of the physicists in Bulgaria 28 September - 1 October 1983, Sofia. Abstracts of reports and short communication, 9:50817 (R;BG;In Bulgarian)
PHYTOPLANKTON
Metabolism
Size distribution of planktonic autotrophy and microheterotrophy in DeGray Reservoir, Arkansas, 9:50564 (R;US)
Monthly Variations
Temporal and spatial variability of phytoplankton in a subtropical ecosystem, 9:50565 (J;US)
Spatial Distribution
Temporal and spatial variability of phytoplankton in a subtropical ecosystem, 9:50565 (J;US)
PICEANCE CREEK BASIN
Water Quality
Characterization of oil shale mine waters, central Piceance Basin, Colorado. Final report, 9:49505 (R;US)
PIG ION SOURCES
See PENNING ION SOURCES
PIGE ANALYSIS
See NUCLEAR REACTION ANALYSIS
PROTON REACTIONS
PIGMENT CELLS
See ANIMAL CELLS
PIGMENTS
PIGMENTS
X-Ray Fluorescence Analysis
Energy dispersive X-ray elemental analysis for pigments identification of tempera painting, 9:50270 (RA;BG;In Bulgarian)
PI-MU ATOMS
Pions and muons - beyond exotic atoms, 9:50731 (RA;AU)
PION MINUS REACTIONS
Charge-Exchange Reactions
Dependence of the excitation energy, width, and cross section of the isovector monopole resonance, 9:50878 (J;FR)
Inelastic Scattering
Excitation of giant resonances in pion inelastic scattering, 9:50847 (J;FR)
PION PLUS REACTIONS
Charge-Exchange Reactions
Contributions of pair correlations to pion-nucleus double charge exchange, 9:50916 (R;US)
Dependence of the excitation energy, width, and cross section of the isovector monopole resonance, 9:50878 (J;FR)
Elastic Scattering
Tensor polarisation t_{20} in pion-deuteron elastic scattering, 9:50832 (RA;AU)
Inelastic Scattering
Excitation of giant resonances in pion inelastic scattering, 9:50847 (J;FR)
PION REACTIONS
See also PION MINUS REACTIONS
PION PLUS REACTIONS
Capture
Capture of pions by nuclei, 9:50912 (RA;SU;In Russian)
Charge-Exchange Reactions
Excitation of giant resonances in pion charge-exchange reactions, 9:50879 (J;FR)
Inelastic Scattering
Analytic distorted wave approximation for intermediate energy pion and proton inelastic scattering, 9:50836 (RA;AU)
Scattering
Spin dependent effects in pion-nucleus scattering, 9:50910 (RA;AU)
PIONS
See also PIONS NEUTRAL
Pions and muons - beyond exotic atoms, 9:50731 (RA;AU)
PIONS NEUTRAL
Particle Production
Near-threshold production of neutral π mesons in heavy-ion reactions, 9:50848 (R;US)
PIPELINES
Acoustic Emission Testing
Defect detection by acoustic emission. Part 2, 9:49486 (J;US)
Defect detection by acoustic emission. Part 1, 9:49487 (J;US)
Bonding
Self-contained exothermic applicator and process, 9:50384 (P;US)
Construction
Alaska Natural Gas Transportation System, 9:49485 (R;US)
Defects
Judging defect severity on offshore pipelines, 9:49471 (J;US)
Failures
Judging defect severity on offshore pipelines, 9:49471 (J;US)
Fuel Cells
Study of pipeline applications of fuel cells. Final report, 9:49961 (R;US)

Sealing Materials
Self-contained exothermic applicator and process, 9:50384 (P;US)
PIPES
Impact Shock
Pipe to pipe impact, 9:49898 (R;US)
Materials
Design baseline: 6000 tpd SRC-1 Demonstration Plant. Volume 5 (revised) (SRC-1 Demonstration Plant), 9:49351 (R;US)
Specifications
Design baseline: 6000 tpd SRC-1 Demonstration Plant. Volume 5 (revised) (SRC-1 Demonstration Plant), 9:49351 (R;US)
Thermal Shock
Loadings in horizontal feedwater pipes of LWRs by thermal shock and temperature differences due to thermal layers, 9:49767 (RA;DE;In German)
PITTSBURG-MIDWAY SOLVENT REFINED COAL PRO
See SRC PROCESS
PITUITARY GLAND
Biological Radiation Effects
Delayed sequelae of pituitary irradiation, 9:50626 (J;US)
PLANT DISEASES
Correlations
Effects of sulfur dioxide on expansion of lesions caused by Corynebacterium nebraskense in maize and by Xanthomonas phaseoli var. sojensis in soybean, 9:50649 (J;US)
PLANT GROWTH
Mathematical Models
Comparison of tree growth models, 9:50548 (R;US)
PLANTS (INDUSTRIAL)
See INDUSTRIAL PLANTS
PLANTS (POWER)
See POWER PLANTS
PLASMA
See also LASER-PRODUCED PLASMA
SOLID-STATE PLASMA
Alfven Waves
Shear-Alfven dynamics of toroidally confined plasmas. Part B, 9:51006 (R;US)
Shear-Alfven dynamics of toroidally confined plasmas. Part A, 9:51005 (R;US)
Impurities
Plasma surface interaction processes and possible synergisms, 9:51026 (R;US)
Surfaces
Plasma surface interaction processes and possible synergisms, 9:51026 (R;US)
PLASMA DIAGNOSTICS
Far Infrared Radiation
Far-infrared laser diagnostic on EBT and extreme far-forward laser scattering on ISX, 9:51002 (R;US)
Proton Beams
Measurement of proton autoneutralization potential, 9:51010 (R;US)
X-Ray Spectrometers
Application of layered synthetic microstructures to high-temperature plasma diagnostics, 9:50498 (R;US)
PLASMA OSCILLATIONS
See PLASMA WAVES
PLASMA (QUARK)
See QUARK MATTER
PLASMA WAVES
Dispersion Relations
Josephson-type oscillations in a moving charge-density wave interacting with magnetic impurities, 9:50212 (J;US)
Hybrid Resonance
Computational model for lower hybrid current drive, 9:50991 (RA;GB)
Interaction of lower hybrid waves with fast electron tails in FT, 9:50998 (RA;GB)
Interpretation of LH current drive experiments, 9:50988 (RA;GB)
Lower hybrid current drive in the PLT tokamak, 9:50999 (RA;GB)
Nonlinear theory of lower hybrid current drive - a two-dimensional Fokker-Planck study, 9:50986 (RA;GB)
Numerical simulation of current drive by lower hybrid waves, 9:50990 (RA;GB)
Plasma heating and current drive in a tokamak by the fast mode of low hybrid waves, 9:50995 (RA;GB)
rf current drive in the presence of a dc electric field, 9:50993 (RA;GB)
Stochastic generation of currents by lower-hybrid waves, 9:50994 (RA;GB)
Two-dimensional and relativistic effects in lower-hybrid current drive, 9:50987 (RA;GB)
Velocity redistribution in lower hybrid current drive, 9:50992 (RA;GB)
Transition Radiation
Transition scattering and transition bremsstrahlung in a dense plasma - a step towards soft x-ray lasers, 9:51008 (R;HU)
PLASTICS
See also POLYSTYRENE
Electroplating
Electroless metal plating of plastics, 9:50179 (P;US)
PLATES
Thicker than SHEETS or FOILS.
Temperature Gradients
Measurement and calculation of the three-dimensional instationary temperature field in underwater welded plates, 9:50112 (R;DE;In German)
Welded Joints
Measurement and calculation of the three-dimensional instationary temperature field in underwater welded plates, 9:50112 (R;DE;In German)
PLATINUM 188
Heavy Ion Reactions
Heavy ion induced fission reactions, 9:50891 (RA;AU)
Neutron evaporation following heavy ion reactions for systems with $150 < A < 190$, 9:50883 (RA;AU)
PLATINUM ISOTOPES
See also PLATINUM 188
High Spin States
Bose-fermi U(6/2j+1) supersymmetries and high spin anomalies, 9:50903 (R;AU)
Interacting Boson Model
Bose-fermi U(6/2j+1) supersymmetries and high spin anomalies, 9:50903 (R;AU)
PLT DEVICES
Current-Drive Heating
Computational model for lower hybrid current drive, 9:50991 (RA;GB)
Lower hybrid current drive in the PLT tokamak, 9:50999 (RA;GB)
Plasma Waves
Lower hybrid current drive in the PLT tokamak, 9:50999 (RA;GB)
Steady-State Conditions
Lower hybrid current drive in the PLT tokamak, 9:50999 (RA;GB)
PLUMES
Diffusion
MESOI, an interactive atmospheric dispersion model for emergency response applications, 9:50542 (R;US)
PLUTONIUM
Environment
Radioecological research on the behavior of actinides in the environment, 9:49870 (RA;DE;In German)
Physical Metallurgy
Actinides: from heavy fermions to plutonium metallurgy, 9:50132 (R;US)
Radioecological Concentration
Plutonium contamination in Italian population, 9:50611 (R;IT;In Italian)
PLUTONIUM 239
Subcutaneous Injection
Plutonium-induced wounds in beagles, 9:50621 (J;GB)
Toxicity
Role of histological techniques for preparation of bone in studies of Pu, 9:50610 (R;IT;In Italian)
PLUTONIUM ISOTOPES
See also PLUTONIUM 239

Mass Spectroscopy
High-precision isotopic analysis of nanogram quantities of plutonium, 9:50290 (R;US)
PLUTONIUM NITRATES
Subcutaneous Injection
Plutonium-induced wounds in beagles, 9:50621 (J;GB)
PLUTONIUM OXIDES
Encapsulation
Laboratory techniques for safe encapsulation of α-emitting powder samples, 9:50363 (R;GB)
Subcutaneous Injection
Plutonium-induced wounds in beagles, 9:50621 (J;GB)
PLUTONIUM RECYCLE
Safeguards
Safety strategy for the use of plutonium, 9:49793 (R;DE;In German)
P-N JUNCTIONS
Annealing
Modified laser-annealing process for improving the quality of electrical P-N junctions and devices, 9:50427 (P;US)
PNA
See POLYCYCLIC AROMATIC HYDROCARBONS
PNEUMOCONIOSES
Meetings
Silica, silicosis and cancer. An international symposium, 9:50631 (R;US)
POINT CONTACTS
See ELECTRIC CONTACTS
POISEUILLE FLOW
See LAMINAR FLOW
POISONS (CHEMICAL)
See HAZARDOUS MATERIALS
POLARIMETERS
Design
Multiparameter light scattering for rapid virus identification, 9:50599 (R;US)
POLARIZED TARGETS
Physical Radiation Effects
Radiation damage in an ethylamine-borane:ammonia target, 9:50441 (R;US)
POLICY
See ENERGY POLICY
ENVIRONMENTAL POLICY
POLLUTANTS
Not for radioactive contaminants for which use RADIOACTIVE WASTES or other related terminology.
Biological Effects
Effects of air pollutants on plant cell tissue cultures (Tobacco, rose soybean, periwinkle, and morning glory), 9:50651 (B;US)
Data Compilation
Compilation of data sources for existing chemicals, 9:50635 (R;DE)
Ecological Concentration
Effects of air pollutants on plant cell tissue cultures (Tobacco, rose soybean, periwinkle, and morning glory), 9:50651 (B;US)
Environmental Transport
Microcosm as a tool for estimation of environmental transport of toxic materials, 9:50555 (J;GB)
Health Hazards
Health effects of risk-assessment categories, 9:50629 (R;US)
Marine Disposal
Oceanographic model for the dispersion of wastes disposed of in the deep sea, 9:50577 (R;XA)
Monitoring
Feasibility of using fiber optics for monitoring groundwater contaminants, 9:50575 (J;US)
Remote Sensing
Feasibility of using fiber optics for monitoring groundwater contaminants, 9:50575 (J;US)
Tissue Distribution
Effects of air pollutants on plant cell tissue cultures (Tobacco, rose soybean, periwinkle, and morning glory), 9:50651 (B;US)
POLLUTION CONTROL
Use this term for items that involve the removal or management of pollutants after they are formed by a source.
See also AIR POLLUTION CONTROL
Regulations
Federal efforts to control the environmental and health effects of synthetic fuels development, 9:49928 (R;US)
POLLUTION CONTROL EQUIPMENT
See also BAGHOUSES
ELECTROSTATIC PRECIPITATORS
SCRUBBERS
Efficiency
Removal of polynuclear aromatic hydrocarbons from primary aluminum air pollution control scrubber wastewater, 9:50572 (R;US)
POLONIUM 201
Decay
Nuclear chemistry research and spectroscopy with radioactive sources. Twentieth annual progress report, September 1, 1983-August 31, 1984, 9:50869 (R;US)
POLONIUM 210
Heavy Ion Reactions
Heavy ion induced fission reactions, 9:50891 (RA;AU)
Lung Clearance
Lung-clearance classification of radionuclides in coal fly ash, 9:49441 (J;GB)
X-Ray Fluorescence Analysis
Lung-clearance classification of radionuclides in coal fly ash, 9:49441 (J;GB)
POLYACRYLONITRILE
See ORGANIC POLYMERS
POLYAMIDES
Molecular Weight
Improved polymers for enhanced oil recovery synthesis and rheology. Sixth annual report, October 1982-September 1983, 9:49447 (R;US)
POLYCYCLIC AROMATIC HYDROCARBONS
Removal
Removal of polynuclear aromatic hydrocarbons from primary aluminum air pollution control scrubber wastewater, 9:50572 (R;US)
POLY(ISOBUTYLENE OXIDE)
See ORGANIC POLYMERS
POLYMER FLOODING
See MICROEMULSION FLOODING
WATERFLOODING
POLYMERASES
Enzyme Activity
Effect of 3-aminobenzamide on the rate of ligation during repair of alkylated DNA in human fibroblasts, 9:50646 (J;US)
POLYMERS
See also ORGANIC POLYMERS
SILICONES
Dislocations
Dislocation theory, 9:50181 (BA;FR)
Extrusion
Optimization of the die entrance shape for polymeric extrusion, 9:50178 (R;US)
Structural Chemical Analysis
Microstructural analysis of ion containing polymers. Final report, July 1, 1981-June 30, 1984, 9:50175 (R;US)
POLYNUCLEAR AROMATIC HYDROCARBONS
See POLYCYCLIC AROMATIC HYDROCARBONS
POLYSTYRENE
Sorptive Properties
Separation factor method for the analysis of ideal binary mixtures in gas-solid adsorption, 9:50293 (J;US)
Structural Chemical Analysis
Microstructural analysis of ion containing polymers. Final report, July 1, 1981-June 30, 1984, 9:50175 (R;US)
POLYSULFIDES
See SULFIDES
POLYTETRAOXANE
See ORGANIC POLYMERS
POLYTHIONATES
See OXYGEN COMPOUNDS
SULFUR COMPOUNDS
POLYTHIONIC ACIDS
See OXYGEN COMPOUNDS
SULFUR COMPOUNDS

POLY(VINYLIDENE FLUORIDE)
See FLUORINATED ALIPHATIC HYDROCARBONS
POOL CRITICAL ASSEMBLY ORNL
See ORNL-PCA REACTOR
PORK
See MEAT
POROUS MATERIALS
Mathematical Models
Three-dimensional model for a porous elastic anisotropic solid with inclusions, taking into account dissipation, heat flux, radiation and thermal stress, 9:51061 (R;US)
Surface Coating
Method for depositing a uniform layer of particulate material on the surface of an article having interconnected porosity, 9:50215 (P;US)
PORPHYRINS
Excitation
Spectral properties of protonated Schiff base porphyrins and chlorins. INDO-CI calculations and resonance raman studies, 9:50337 (J;US)
Photochemical Reactions
Polyelectrolytes as interfaces for retarding back-reaction in photoinduced electron transfer, 9:50335 (R;US)
Structural Chemical Analysis
Spectral properties of protonated Schiff base porphyrins and chlorins. INDO-CI calculations and resonance raman studies, 9:50337 (J;US)
PORTLAND CEMENT
Additives
Method for incorporating radioactive phosphoric acid solutions in concrete, 9:50216 (P;US)
POSITION SENSITIVE DETECTORS
Accuracy
High position resolution and accuracy in ^{3}He two-dimensional thermal neutron PSDs, 9:50489 (BA;GB)
Counting Rates
Recent developments in position-sensitive neutron counting, 9:50490 (BA;GB)
Data Processing
Data processing in neutron protein crystallography using position-sensitive detectors, 9:50492 (BA;GB)
Neutron Flux
Recent developments in position-sensitive neutron counting, 9:50490 (BA;GB)
Performance
Spatial resolution of neutron-position scintillation detectors, 9:50488 (BA;GB)
Reviews
Summary of position-sensitive detector workshop Institut Laue-Langevin, Grenoble, France 11-12 October 1982, 9:50493 (BA;GB)
Spatial Resolution
High position resolution and accuracy in ^{3}He two-dimensional thermal neutron PSDs, 9:50489 (BA;GB)
Spatial resolution of neutron-position scintillation detectors, 9:50488 (BA;GB)
POSITRONS
Decay
The contribution of cosmogenic radioisotopes to solar neutrino flux measurements, 9:50709 (J;US)
Elastic Scattering
Radiation at particle scattering in ultrathin crystals, 9:50952 (RA;SU;In Russian)
POTASSIUM
Absorption
High-temperature removal of alkali vapors in hot-gas cleaning systems, 9:49343 (RA;US)
Absorption Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Activation Analysis
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Electronic Structure
Calorimetric investigation into the possibility of a charge density wave ground state in alkali metals, 9:50133 (R;US)
Emission Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Proton Microprobe Analysis
Elemental microanalysis of individual blood cells, 9:50277 (RA;AU)
Specific Heat
Calorimetric investigation into the possibility of a charge density wave ground state in alkali metals, 9:50133 (R;US)
POTASSIUM 40
Gamma Spectroscopy
Gamma-spectrometrical measurements in-situ of natural waters in Bulgaria, 9:50578 (RA;BG;In Bulgarian)
Radioecological Concentration
Gamma-ray emitting radionuclides in environmental samples from the South-West Bulgaria, 9:50558 (RA;BG;In Bulgarian)
Joint comparative research on gamma-ray emitting radionuclides in samples from the Danube-Black Sea territorial complex, 9:50559 (RA;BG;In Bulgarian)
POTASSIUM 41 TARGET
Proton Reactions
^{41}K(p,α)^{38}Ar cross section and its significance for nucleosynthesis, 9:50864 (RA;AU)
POTASSIUM CARBONATES
Catalytic Effects
Development of an advanced water-gas shift conversion system. Monthly project status report No. 6, September 1-30, 1984, 9:49357 (R;US)
Chemical Reaction Kinetics
Development of a hot gas cleanup system for integrated coal gasification/molten carbonate fuel cell power plants, 9:49341 (RA;US)
POTASSIUM CHLORIDES
Edge Dislocations
Movement of edge dislocations in KCl by large electric fields, 9:50254 (J;GB)
POTASSIUM FLUORIDES
Ion Collisions
Punch-through of atomic planes at a shallow incidence angle of proton beam, 9:50739 (RA;SU;In Russian)
POTASSIUM PERMANGANATES
Hot Atom Chemistry
Model for the mechanism of stabilization of the Mn-56 "hot" atom and the obtaining of its different valent forms through the (n,) reaction in solid $KMnO_4$, 9:50349 (RA;BG;In Bulgarian)
POTASSIUM PHOSPHATES
Solubility
High temperature aqueous solutions and energy considerations - physical chemical studies, 9:50298 (R;US)
POTENTIOMETRY
Titration
Kitchensink titrations, 9:50303 (R;US)
POWER BURST FACILITY USAEC
See PBF REACTOR
POWER DEMAND
Forecasting
Need for new powerplants. Hearing before the Subcommittee on Energy Conservation and Power of the Committee on Energy and Commerce, House of Representatives, Ninety-Eighth Congress, Second Session on Congressional Research Service and Department of Energy Electric Utility Reports, February 7, 1984, 9:49954 (B;US)
Residential load forecasting: intergrating end-use and econometric methods, 9:49983 (RA;US)
POWER GENERATION
See also COGENERATION
Environmental Impacts
Atmospheric science and power production, 9:50527 (R;US)
Health Hazards
Methodology for comparing the health effects of electricity generation from uranium and coal fuels, 9:49440 (R;US)
POWER PLANTS
See also HYDROELECTRIC POWER PLANTS
SOLAR POWER PLANTS
THERMAL POWER PLANTS

WIND POWER PLANTS
Government Policies
Need for new powerplants. Hearing before the Subcommittee on Energy Conservation and Power of the Committee on Energy and Commerce, House of Representatives, Ninety-Eighth Congress, Second Session on Congressional Research Service and Department of Energy Electric Utility Reports, February 7, 1984, 9:49954 (B;US)
Load Management
Studies on load management in the range of minute-to-minute up to hour-to-hour planning by means of dynamic optimization, 9:49760 (R;DE;In German)
Systems Analysis
Methods and models for system assessment of long-term development of energy complex of People's Republic of Bulgaria, 9:49924 (RA;BG;In Bulgarian)
POWER POOLS
See INTERCONNECTED POWER SYSTEMS
POWER REACTORS
See also AVR REACTOR
BIBLIS-A REACTOR
BIBLIS-B REACTOR
BRAIDWOOD-1 REACTOR
BRAIDWOOD-2 REACTOR
GROHNDE REACTOR
SHOREHAM REACTOR
SIZEWELL-B REACTOR
SPACE POWER REACTORS
SURRY-2 REACTOR
THREE MILE ISLAND-2 REACTOR
ZION-1 REACTOR
Containment Buildings
DEMONA - research program for the demonstration of nuclear aerosol behaviour, 9:49872 (R;DE;In German)
Core Catchers
Benefit effort relation of sacrificial layers, 9:49845 (R;DE;In German)
Data Compilation
Licensed Operating Reactors. Status summary report, data as of July 31, 1984. Volume 8, No. 8, 9:49763 (R;US)
Fuel Cans
SSYST-3. Input description, 9:49873 (R;DE;In German)
Hydraulics
Efficient numerical methods for analysis of nuclear reactor thermohydraulics, 9:49799 (RA;BG;In Bulgarian)
Loss of Coolant
SSYST-3. Input description, 9:49873 (R;DE;In German)
Meltdown
Benefit effort relation of sacrificial layers, 9:49845 (R;DE;In German)
Investigation of the meltdown accident with special regard to the radiological state of knowledge, 9:49847 (R;DE;In German)
Reactor Decommissioning
Utility financial stability and the availability of funds for decommissioning, 9:49787 (R;US)
Reactor Operation
Power Reactor Events, March-April 1984. Volume 6, No. 2, 9:49764 (R;US)
POWER SYSTEMS
Includes electric power networks with associated generating and transmission facilities.
See also DC SYSTEMS
INTERCONNECTED POWER SYSTEMS
RANKINE CYCLE POWER SYSTEMS
Control Systems
Microprocessor-based monitoring and control project. Phase I report, 9:50504 (R;US)
Monitoring
Microprocessor-based monitoring and control project. Phase I report, 9:50504 (R;US)
Wind Turbines
Wind power parks: 1983 survey, 9:49735 (R;US)
POWER TRANSMISSION
Planning
Simple transmission network planning method: Wisconsin power plant impact study, 9:49761 (R;US)
POWER TRANSMISSION LINES
Environmental Impacts
Effects of electromagnetic fields produced by high voltage transmission lines. Final report, 9:50652 (R;US)
Health Hazards
Effects of electromagnetic fields produced by high voltage transmission lines. Final report, 9:50652 (R;US)
POWERED SUPPORTS
Performance Testing
Novel shield support for coal faces worked by shearer loaders in difficult geological conditions with modern ergonomic layout, 9:49410 (R;DE;In German)
PREONS
Bound State
Bound state Regge trajectories in N=8 supergravity, 9:50814 (BA;US)
PRESSURE VESSELS
Crack Propagation
Crack growth under cyclic thermal shock loading, 9:49804 (RA;DE;In German)
Cracks
Minimum critical crack depths in pressure vessels guidelines for nondestructive testing, 9:49802 (R;GB)
Damaging Neutron Fluence
ORNL evaluation of the ORR-PSF metallurgical experiment and blind test, 9:49833 (R;US)
Fracture Properties
Crack growth under cyclic thermal shock loading, 9:49804 (RA;DE;In German)
Pressurized thermal shock program sponsored by EPRI, 9:49772 (RA;DE)
Manufacturing
Manufacturing of ultra-large diameter 20 MnMoNi 5 5 steel forgings for reactor pressure vessels and their properties, 9:50116 (RA;DE)
Materials
Advanced Research and Technology Development Fossil Energy Materials Program. Quarterly progress report ending June 30, 1984, 9:50094 (R;US)
Ultrasonic Testing
Control and evaluation part of equipment for testing WWER 440 pressure vessels, 9:49773 (RA;CS;In Czech)
Minimum critical crack depths in pressure vessels guidelines for nondestructive testing, 9:49802 (R;GB)
PRESSURIZED WATER COOLED MODERATED REACTO
See PWR TYPE REACTORS
PRESSURIZED WATER REACTORS
See PWR TYPE REACTORS
PRICES
Prior to June 1979, CHARGES was used.
Forecasting
Energy: challenges and opportunities for the Middle Atlantic United States. Volume 2. Background articles, 9:49917 (R;US)
PRIMARY COOLANT CIRCUITS
Computerized Simulation
Simulation of the dynamic behaviour of the primary circuit in a WWER-440 type nuclear power plant Pt. 1, 9:49777 (R;HU)
Fault Tree Analysis
Reliability analysis of selected systems of nuclear power unit, 9:49774 (RA;CS;In Czech)
Fracture Properties
US NRC research on the integrity of piping in nuclear reactor primary systems, 9:49768 (RA;DE)
Reactor Control Systems
Non-sampling gamma-spectrometric analysis of IRT-2000 reactor coolant, 9:49826 (RA;BG;In Bulgarian)
PRIMARY COSMIC RADIATION
See also COSMIC GAMMA BURSTS
Composition of cosmic radiation for energies of more than 100 TeV, 9:50671 (RA;AU)
Future of cosmic ray physics, 9:50670 (RA;AU)
PRINCETON LARGE TORUS
See PLT DEVICES
PROCESS HEAT REACTORS
Feasibility Studies
National need for utilizing nuclear energy for process heat generation, 9:49795 (R;US)

PROCESSING (DATA)
See DATA PROCESSING
PROCESSING (WASTES)
See WASTE PROCESSING
PRODUCTION (HYDROGEN)
See HYDROGEN PRODUCTION
PROGRAMMING
Limited to computer programming.
Software tools, 9:50380 (RA;US)
Text Editors
Portable, public domain LEX for the Software Tools, 9:51056 (R;US)
PROMETHIUM 149
Beta-Minus Decay
Opposing properties of particle-hole and intruder-hole bands in N = 87 nuclei and ^{149}Sm levels populated by ^{149}Pm (β^-) and ^{149}Eu(EC), 9:50881 (J;GB)
PRONGS
See PARTICLE TRACKS
PROPANE
Chemical Reactions
Reactions of $FeCH_3i$ and $CoCH_3^+$ with aliphatic alkanes in the gas phase, 9:50322 (J;US)
Data Compilation
Petroleum supply monthly, July 1984, 9:49454 (R;US)
Dehydrogenation
Kinetics - studies I. Model experiments with dehydrogenation of propane and isomerization of pentane, 9:50319 (R;NO;In Norwegian)
Sales
Petroleum marketing monthly, July 1984, 9:49455 (R;US)
1-PROPANOL
See PROPANOLS
2-PROPANOL
See PROPANOLS
PROPANOLS
Radiolysis
Picosecond pulse radiolysis studies to understand the primary processes in radiolysis, 9:50346 (R;US)
PROPELLANTS
Equations of State
Experimental high pressure equation of state of a very fast burning gun propellant, 9:50506 (R;US)
Quantitative Chemical Analysis
Kitchensink titrations, 9:50303 (R;US)
PROPIOLONITRILE
Spectra
Molecular beam electric resonance study of the ground and excited states of cyano acetylene, 9:50318 (R;US)
PROPYL ALCOHOLS
See PROPANOLS
PROPYL RADICALS
Formation Heat
Photoelectron spectroscopy of 1-propyl, 1-butyl, isobutyl, neopentyl, and 2-butyl radicals: free radical precursors to high-energy carbonium ion isomers (Studied at elevated temperature to increase extent of radical decomposition), 9:50357 (J;US)
Ionization Potential
Photoelectron spectroscopy of 1-propyl, 1-butyl, isobutyl, neopentyl, and 2-butyl radicals: free radical precursors to high-energy carbonium ion isomers (Studied at elevated temperature to increase extent of radical decomposition), 9:50357 (J;US)
PROSTHESES
Materials Testing
Ion implantation of surgical Ti-6Al-4V alloy, 9:50590 (R;US)
PROTECTION
See SAFETY
PROTECTION (RADIATION)
See RADIATION PROTECTION
PROTECTIVE COATINGS
Adhesion
Hydrothermal durability of Ca-complexed methylmethacrylate-trimethylolpropane trimethacrylate copolymer films and coatings containing superficially formed $CaO\text{-}SiO_2\text{-}H_2O$ type inorganic macromolecules, 9:50172 (R;US)
Electrodeposition
Method for preparing surfaces of metal composites having a brittle phase for plating, 9:50148 (P;US)
PROTEINS
Crystallography
Data processing in neutron protein crystallography using position-sensitive detectors, 9:50492 (BA;GB)
PROTON BEAMS
Beam Neutralization
Measurement of proton autoneutralization potential, 9:51010 (R;US)
Space Charge
Measurement of proton autoneutralization potential, 9:51010 (R;US)
PROTON BLOCKING
See PROTON CHANNELING
PROTON CHANNELING
Decay of a packet incident on monocrystal and evolution of a two-particle system and its motion in medium, 9:50950 (RA;SU;In Russian)
Binary Encounter Method
Axial channeling in a thick monocrystal, 9:50947 (RA;SU;In Russian)
Monocrystals
Axial channeling in a thick monocrystal, 9:50947 (RA;SU;In Russian)
PROTON MICROPROBE ANALYSIS
Scanning proton microprobe and its place in elemental microanalysis, 9:50271 (RA;AU)
PROTON PROBES
Scanning proton microprobe and its place in elemental microanalysis, 9:50271 (RA;AU)
PROTON REACTIONS
Analyzing Power
Comparison of neutron-deuteron and proton-deuteron analysing powers, 9:50831 (RA;AU)
Capture
^{58}Ni(p,γ)^{59}Cu cross section and its importance for nucleosynthesis and statistical model studies, 9:50859 (RA;AU)
Proton induced reactions on ^{37}Cl and their relevance to nucleosynthesis, 9:50853 (RA;AU)
Compound-Nucleus Reactions
Use of total shadow profiles for obtaining the information on compounds nuclei lifetime, 9:50854 (RA;SU;In Russian)
Glauber Theory
Medium energy probes and the IBM, 9:50915 (R;US)
Inclusive Interactions
Description of fragmentation as a critical phenomenon in high energy p-nucleus collisions, 9:50868 (J;NL)
Inelastic Scattering
Analyses of electron and proton scattering to low excitation isoscalar states in ^{20}Ne, ^{24}Mg and ^{28}Si, 9:50856 (R;AU)
Analytic distorted wave approximation for intermediate energy pion and proton inelastic scattering, 9:50836 (RA;AU)
Inelastic scattering of intermediate energy protons from tungsten, 9:50885 (RA;AU)
Medium corrections in inelastic proton scattering at intermediate energies, 9:50911 (RA;AU)
Interacting Boson Model
Medium energy probes and the IBM, 9:50915 (R;US)
Knock-Out Reactions
^{40}Ca(p,pd)^{38}K and ^{40}Ca(p,2p)^{39}K reactions at 150 MeV, 9:50862 (RA;AU)
Multiple Scattering
Medium energy probes and the IBM, 9:50915 (R;US)
Pickup Reactions
^{41}K(p,α)^{38}Ar cross section and its significance for nucleosynthesis, 9:50864 (RA;AU)
Shadow Effect
Influence of orientation of compound nuclei displacement in diametrical plane on axial shadow shape, 9:50855 (RA;SU;In Russian)

PROTONS
Pair Production
Evidence for local compensation of baryon number in e^+e^- annihilation, 9:50764 (R;DE)
Weak Particle Decay
Proton decay in the framework of a non-relativistic potential model, 9:50786 (R;AT)
PUBLIC BUILDINGS
Heat Losses
Remote sensing survey of energy losses from public buildings. Final report, 9:50002 (R;US)
Infrared Thermography
Remote sensing survey of energy losses from public buildings. Final report, 9:50002 (R;US)
PUBLIC LAW 94-370
See COASTAL ZONE MANAGEMENT ACT
PULPS
See SLURRIES
PULVERIZED FUEL ASH
See FLY ASH
PUMPS
See also WIND-POWERED PUMPS
Comparative Evaluations
Pump for metering high-level waste and glass former mixtures to an electric melter, 9:49555 (R;US)
PWR TYPE REACTORS
See also BIBLIS-A REACTOR
BIBLIS-B REACTOR
BRAIDWOOD-1 REACTOR
BRAIDWOOD-2 REACTOR
GROHNDE REACTOR
SIZEWELL-B REACTOR
SURRY-2 REACTOR
THREE MILE ISLAND-2 REACTOR
WWER TYPE REACTORS
ZION-1 REACTOR
Acoustic Monitoring
Spectral analyzer of vibroacoustic signals, 9:49818 (RA;CS;In Czech)
Blowdown
Assessment of integrity for the pressure vessel internals of PWRs under blowdown loadings, 9:49879 (RA;DE;In German)
Cost
Technical reference book for the Energy Economic Data Base (EEDB) Program, 9:49791 (R;US)
Economics
Technical reference book for the Energy Economic Data Base (EEDB) Program, 9:49791 (R;US)
Fuel Element Clusters
Heat transfer in rod bundles with severe clad deformations, 9:49871 (R;DE)
Fuel Management
Extended Fuel Burnup Demonstration Program. Summary final report, 9:49770 (R;US)
Meltdown
MARCH 2 (Meltdown Accident Response Characteristics) code description and user's manual, 9:49894 (R;US)
Pipes
Loadings in horizontal feedwater pipes of LWRs by thermal shock and temperature differences due to thermal layers, 9:49767 (RA;DE;In German)
Pressure Vessels
Pressurized thermal shock program sponsored by EPRI, 9:49772 (RA;DE)
Primary Coolant Circuits
US NRC research on the integrity of piping in nuclear reactor primary systems, 9:49768 (RA;DE)
Reactor Accidents
Categorization of PWR accident sequences and guidelines for fault trees: seismic initiators, 9:49901 (R;US)
Pipe to pipe impact, 9:49898 (R;US)
Probability of pipe failure in the reactor coolant loops of Combustion Engineering PWR plants. Volume 2. Pipe failure induced by crack growth, 9:49890 (R;US)
Review of areas that may require simultaneous coupled solution of the thermal hydraulic and fission product/aerosol behavior equations for source term determination, 9:49853 (R;US)
Reactor Components
Fluid-structure-interaction of the pressurized water reactor core internals during blowdown - numerical simulation with a homogenization model, 9:49883 (R;DE;In German)
Vibroacoustic diagnostic system, 9:50412 (RA;CS;In Czech)
Reactor Instrumentation
Requirements for diagnostic measurement in pressurized water reactor nuclear power plants, 9:49822 (RA;CS;In Czech)
Reactor Safety
Engineer-constructor's view of nuclear power plant safety, 9:49876 (RA;DE)
EPRI research on hydrogen combustion and control, 9:49866 (RA;DE)
Steam Generators
Evaluation of on-line chelant addition dilute chemical cleaning. Final report, 9:49771 (R;US)
PYRIDINIUM COMPOUNDS
Chemical Properties
Electrochemical properties of the solvent $SbCl_3$-$AlCl_3$-N-(1-BUTYL)pyridinium chloride and electrochemical and spectroelectrochemical studies of the solute 9,10-dimethylanthracene, 9:50325 (J;US)
Chemical Reaction Kinetics
Reactivity of anthracene in liquid $SbCl_3$-$AlCl_3$-N-(1-BUTYL)pyridinium chloride mixtures, 9:50327 (J;US)
Chemical Reactions
Constant-current potentiometric titration of orthophosphate with cetylpyridinium chloride: a feasibility study, 9:50295 (J;GB)
Electrical Properties
Electrochemical properties of the solvent $SbCl_3$-$AlCl_3$-N-(1-BUTYL)pyridinium chloride and electrochemical and spectroelectrochemical studies of the solute 9,10-dimethylanthracene, 9:50325 (J;US)
PYRITE
Activation Energy
The reactivity of pyrite in raw eastern oil shale and its transformation during processing, 9:49506 (BA;US)
PYRITES
See PYRITE

Q

QUANTUM CHROMODYNAMICS
Electron-Positron Interactions
Model dependence of the determination of the strong coupling constant in second order QCD from e^+e^--annihilation into hadrons, 9:50774 (R;DE)
Gluons
Gluon propagator in quantum chromodynamics, 9:50806 (RA;AU)
Jet Model
Merging of jets, 9:50778 (R;DE)
Lattice Field Theory
Hadron spectrum in lattice QCD, 9:50775 (R;DE)
Scaling Laws
Measurement of the photon structure function $F_2sup(\gamma)(x,Q^2)$, 9:50767 (R;DE)
QUANTUM ELECTRODYNAMICS
Bremsstrahlung
Multiple bremsstrahlung in gauge theories at high energies. Pt. 3, 9:50772 (R;DE)
QUANTUM FIELD THEORY
See also LATTICE FIELD THEORY
QUANTUM CHROMODYNAMICS
QUANTUM ELECTRODYNAMICS
QUANTUM GRAVITY
Current Algebra
Current algebra and the local nature of symmetries in local quantum theory, 9:50803 (R;DE)
Locality
Current algebra and the local nature of symmetries in local quantum theory, 9:50803 (R;DE)

Solitons
Soliton bags in quantum field theory, 9:50805 (RA;AU)
QUANTUM GRAVITY
Symmetry Breaking
New results in quantum supergravity, 9:50966 (R;HU)
QUANTUM MECHANICS
What are squeezed states really like, 9:50968 (R;US)
Measure Theory
Repeated measurements in quantum theory, 9:50969 (R;DE)
Theory of generalized observables in quantum mechanics, 9:50956 (RA;BG;In Bulgarian)
Oscillators
Coupled nonlinear oscillators, 9:50387 (B;NL)
Statistical Mechanics
Reduction of the wavepacket: how long does it take, 9:50967 (R;US)
QUANTUM OPERATORS
See also DIRAC OPERATORS
Factorization
Factorization theorem for an exponential operator, 9:50971 (R;AT)
Spherical Harmonics
Representation for spherical harmonics of rotated argument, 9:50972 (R;AT)
QUARK CONFINEMENT
See BAG MODEL
QUARK MATERIAL
See QUARK MATTER
QUARK MATTER
Collective Model
Collective, stochastic and nonequilibrium behavior of highly excited hadronic matter, 9:50920 (J;NL)
Hydrodynamics
Hydrodynamical description of the quark-gluon plasma formation in heavy-ion collisions at intermediate energies, 9:50913 (R;HU)
Irreversible Processes
Collective, stochastic and nonequilibrium behavior of highly excited hadronic matter, 9:50920 (J;NL)
Phase Transformations
Signatures of new phenomena in ultrarelativistic nuclear collisions, 9:50921 (J;NL)
Stochastic Processes
Collective, stochastic and nonequilibrium behavior of highly excited hadronic matter, 9:50920 (J;NL)
QUARK PLASMA
See QUARK MATTER
QUARK SEA
See QUARK MATTER
QUARK-GLUON PLASMA
See QUARK MATTER
QUARKONIUM
A hypothetical bound state of quark and antiquark.
Introduction to ν quarkonium physics, 9:50776 (R;DE)
Energy Levels
Heavy quark physics, 9:50785 (RA;SU;In Russian)
Quantum Chromodynamics
QCD and the spectroscopy of quarkonia, 9:50807 (RA;AU)
S States
W K B approximation for solution of the quasipotential equation with a linear potential, 9:50781 (RA;BG;In Bulgarian)
QUARK-QUARK INTERACTIONS
Wave Functions
Parity admixtures in the nucleon wavefunction, 9:50906 (RA;AU)
QUARKS
Coupling Constants
Experimental test of the flavor independence of the quark-gluon coupling constant, 9:50765 (R;DE)
Rest Mass
Measurement of R and search for the top quark in e^+e^- annihilation between 39.8 and 45.2 GeV, 9:50763 (R;DE)
QUASIPOTENTIAL EQUATION
WKB Approximation
W K B approximation for solution of the quasipotential equation with a linear potential, 9:50781 (RA;BG;In Bulgarian)
QUINONES
Polymerization
New polymer electrodes and conductors based on poly(hydroquinone/quinone) oxidation/reduction systems. Technical progress report, 9:50176 (R;US)

R

RADIATION ACCIDENTS
Emergency Plans
Further actions needed to improve emergency preparedness around nuclear powerplants, 9:49855 (R;US)
Risk Assessment
SSI sensitivity studies and model improvements for the US NRC Seismic Safety Margins Research Program. Rev. 1, 9:49902 (R;US)
RADIATION BELTS
Trapped Protons
Trapped-proton energy spectrum determination (M0002-1), 9:50715 (R;US)
RADIATION BURDEN
See RADIATION DOSES
RADIATION DECONTAMINATION
See DECONTAMINATION
RADIATION DOSEMETERS
See DOSEMETERS
RADIATION DOSES
Computer Calculations
Exposition index calculation from different points in a gamma sterilization plant radiation room, 9:50935 (R;MX;In Spanish)
RADIATION EXPOSURE (DOSES)
See RADIATION DOSES
RADIATION HAZARDS
Industrial Medicine
Radiological work in a university centre. Occupational health problems, 9:50938 (RA;NL;In Dutch)
RADIATION HYGIENE
See RADIATION PROTECTION
RADIATION MONITORING
On-Line Measurement Systems
NIDAC - an on-line program for measurement and anlysis of gamma-ray emitting samples for environmental surveillance, 9:50543 (R;DD;In German)
RADIATION PROTECTION
Research Programs
Radiation, chemicals, and occupational health research, 9:50605 (R;US)
RADIATION SAFETY
See RADIATION PROTECTION
RADIO EQUIPMENT
Photovoltaic Power Supplies
Signal Hill solar-powered repeater report and recommendations, 9:49653 (R;US)
RADIO RECEIVERS
See RADIO EQUIPMENT
RADIO TRANSMITTERS
See RADIO EQUIPMENT
RADIOACTIVE AEROSOLS
Reactor Safety
Release of radioactivity and formation of aerosols during LWR core meltdown, 9:49881 (RA;DE;In German)
RADIOACTIVE BIOLOGICAL WASTES
See RADIOACTIVE WASTES
RADIOACTIVE EFFLUENTS
Information Systems
EADS (Environmental Assessment Data Systems) Liquid Effluents Data System, 1982. Annual report, 9:50571 (R;US)
Radiation Detection
Lower limit of detection: definition and elaboration of a proposed position for radiological effluent and environmental measurements, 9:50540 (R;US)
RADIOACTIVE GASEOUS WASTES
See RADIOACTIVE WASTES

RADIOACTIVE PARTICULATES
See PARTICLES
RADIOACTIVE AEROSOLS
RADIOACTIVE TRACERS
See RADIOPHARMACEUTICALS
RADIOACTIVE WASTE DISPOSAL
Abandoned Sites
Remedial action at the Acid/Pueblo Canyon site, Los Alamos, New Mexico. Final report, 9:49567 (R;US)
Alpha-Bearing Wastes
Pioneering repository development at the Waste Isolation Pilot Plant, 9:49562 (J;GB)
Financial Incentives
Directions in low-level radioactive-waste management. Incentives and compensation: providing resources for communities hosting low-level waste facilities, 9:49543 (R;US)
High-Level Radioactive Wastes
Pioneering repository development at the Waste Isolation Pilot Plant, 9:49562 (J;GB)
Marine Disposal
Oceanographic model for the dispersion of wastes disposed of in the deep sea, 9:50577 (R;XA)
Radionuclide Migration
Exposure and risk calculations for disposal of wastes having minimal radioactivity, 9:49566 (R;US)
Salt Deposits
Pioneering repository development at the Waste Isolation Pilot Plant, 9:49562 (J;GB)
Underground Disposal
Geologic disposal of radioactive waste. An in situ heating experiment in clay rock, 9:49550 (R;IT;In Italian)
Pioneering repository development at the Waste Isolation Pilot Plant, 9:49562 (J;GB)
Programme of research into the management and storage of radioactive waste. Mathematical modelling. Annual report 1983, 9:49529 (R;GB)
Waste-Rock Interactions
Programme of research into the management and storage of radioactive waste. Mathematical modelling. Annual report 1983, 9:49529 (R;GB)
RADIOACTIVE WASTE FACILITIES
See also WIPP
Economic Impact
Nuclear waste repository in basalt: preliminary socioeconomic assessment, 9:49558 (R;US)
Performance
Performance assessment plans and methods for the Salt Repository Project (Contains glossary), 9:49539 (R;US)
Perspective on demonstrations of compliance for high-level waste disposal, 9:49540 (R;US)
Shutdowns
Directions in low-level radioactive waste management. Low-level radioactive waste disposal: commercial facilities no longer operating, 9:49544 (R;US)
Social Impact
Nuclear waste repository in basalt: preliminary socioeconomic assessment, 9:49558 (R;US)
RADIOACTIVE WASTE MANAGEMENT
Compact Commissions
Commission operation. National Low-Level Radioactive Waste Management Program, 9:49546 (R;US)
Computer Codes
Development of the biosphere code BIOMOD: final report, 9:49535 (R;GB)
User's guide to the biosphere code BIOMOD, 9:49534 (R;GB)
RADIOACTIVE WASTE PROCESSING
Incinerators
Design and operational experience with the off-gas cleaning system of the Seibersdorf incinerator plant, 9:49552 (R;AT)
Liquid Wastes
Considerations on the dimensioning of decay tanks for liquid radioactive wastes. Basic methods and examples, 9:49553 (R;AT;In German)
Low-Level Radioactive Wastes
Considerations on the dimensioning of decay tanks for liquid radioactive wastes. Basic methods and examples, 9:49553 (R;AT;In German)
Pumps
Pump for metering high-level waste and glass former mixtures to an electric melter, 9:49555 (R;US)
RADIOACTIVE WASTE STORAGE
See also MONITORED RETRIEVABLE STORAGE
Containment Shells
Corrosion studies on containment materials for vitrified high level nuclear waste. Annual progress report for 1983, 9:49532 (R;GB)
High-Level Radioactive Wastes
Corrosion studies on containment materials for vitrified high level nuclear waste. Annual progress report for 1983, 9:49532 (R;GB)
Liquid Wastes
Considerations on the dimensioning of decay tanks for liquid radioactive wastes. Basic methods and examples, 9:49553 (R;AT;In German)
Low-Level Radioactive Wastes
Considerations on the dimensioning of decay tanks for liquid radioactive wastes. Basic methods and examples, 9:49553 (R;AT;In German)
Risk Assessment
BIOMOD - preliminary findings, 9:49537 (R;GB)
Development of biosphere codes for use in assessment of the radiological impact of geological repositories for radioactive waste, 9:49536 (R;GB)
Sea Bed
Remote assessment of permeability/thermal diffusivity of consolidated clay sediments, 9:49551 (R;GB)
Underground Storage
Corrosion studies on containment materials for vitrified high level nuclear waste. Annual progress report for 1983, 9:49532 (R;GB)
Development of biosphere codes for use in assessment of the radiological impact of geological repositories for radioactive waste, 9:49536 (R;GB)
Radionuclide source term and migration. Progress report April 1983 - September 1983, 9:49526 (R;GB)
RADIOACTIVE WASTES
See also ALPHA-BEARING WASTES
HIGH-LEVEL RADIOACTIVE WASTES
LOW-LEVEL RADIOACTIVE WASTES
RADIOACTIVE EFFLUENTS
Risk Assessment
Impact of risk studies, 9:49936 (R;SE)
RADIOACTIVITY
For measured values of radioactivity and for unidentified radiation sources; not for experimental studies.
Removal
Radionuclide removal for small public water systems. Technical report, 9:50579 (R;US)
RADIOAUTOGRAPHY
See AUTORADIOGRAPHY
RADIOCHEMICAL ANALYSIS
Quality Assurance
Semi-annual report of the Department of Energy, Operational Safety, Health and Environment Division - Quality Assessment Program, 9:50539 (R;US)
RADIOFREQUENCY SYSTEMS
See RF SYSTEMS
RADIOGRAPHY (AUTO)
See AUTORADIOGRAPHY
RADIOGRAPHY (INDUSTRIAL)
See INDUSTRIAL RADIOGRAPHY
RADIOISOTOPE KINETICS
See RADIONUCLIDE KINETICS
RADIOISOTOPE MIGRATION
See RADIONUCLIDE MIGRATION
RADIOISOTOPE-LABELLED DRUGS
See RADIOPHARMACEUTICALS
RADIOISOTOPES
See also NEUTRON-DEFICIENT ISOTOPES
Biological Accumulation
Comparing computing formulas for estimating concentration ratios, 9:50561 (R;US)

Cosmology
The contribution of cosmogenic radioisotopes to solar neutrino flux measurements, 9:50709 (J;US)
Radioecological Concentration
Comparing computing formulas for estimating concentration ratios, 9:50561 (R;US)
RADIOLOGICAL PERSONNEL
Delayed Radiation Effects
Current (1984) status of the study of ^{226}Ra and ^{228}Ra in humans at the Center for Human Radiobiology, 9:50608 (R;US)
Dose Limits
Dose limits for radiological workers, 9:50936 (RA;NL;In Dutch)
Education
Training of medical radiation experts for the occupational health services, 9:50939 (RA;NL;In Dutch)
Medical Surveillance
Radiological work in a university centre. Occupational health problems, 9:50938 (RA;NL;In Dutch)
RADIOLOGICAL PROTECTION
See RADIATION PROTECTION
RADIONUCLIDE CONCENTRATION
See RADIOACTIVITY
RADIONUCLIDE DISTRIBUTIONS
See RADIONUCLIDE KINETICS
RADIONUCLIDE KINETICS
For radionuclides in living organisms only; see also TRANSLOCATION.
Information Systems
The U.S. Transuranium Registry: The final contribution or ultimate gift, 9:50623 (J;US)
RADIONUCLIDE METABOLISM
See RADIONUCLIDE KINETICS
RADIONUCLIDE MIGRATION
In environment.
Computer Codes
BIOMOD - preliminary findings, 9:49537 (R;GB)
Development of biosphere codes for use in assessment of the radiological impact of geological repositories for radioactive waste, 9:49536 (R;GB)
Flow Models
Programme of research into the management and storage of radioactive waste. Fracture hydrology - Cornwall. Annual report 1983, 9:49527 (R;GB)
RADIONUCLIDE TRANSFER (IN ENVIRONMENT)
See RADIONUCLIDE MIGRATION
RADIONUCLIDE TRANSFER (IN ORGANISMS)
See RADIONUCLIDE KINETICS
RADIONUCLIDE TURNOVER
See RADIONUCLIDE KINETICS
RADIONUCLIDES
See RADIOISOTOPES
RADIOPHARMACEUTICALS
Chemical Preparation
^{18}F-4-fluoroantipyrine, 9:50355 (P;US)
Radiohalogen-labeled imaging agents. 3. Compounds for measurement of brain blood flow by emission tomography, 9:50595 (J;US)
RADIOTHORIUM
See THORIUM 228
RADISHES
Chemical Analysis
Lead uptake by perennial ryegrass and radishes from air, water and soil, 9:50650 (J;CA)
RADIUM 226
Body Burden
Current (1984) status of the study of ^{226}Ra and ^{228}Ra in humans at the Center for Human Radiobiology, 9:50608 (R;US)
Lung Clearance
Lung-clearance classification of radionuclides in coal fly ash, 9:49441 (J;GB)
Radioecological Concentration
Gamma-ray emitting radionuclides in environmental samples from the South-West Bulgaria, 9:50558 (RA;BG;In Bulgarian)
Methods and results of EPA's study of radon in drinking water, 9:50576 (R;US)
Uranium series disequilibrium measurements at MOL and Whiteshell. Annual progress report for 1983, 9:49530 (R;GB)
X-Ray Fluorescence Analysis
Lung-clearance classification of radionuclides in coal fly ash, 9:49441 (J;GB)
RADIUM 228
Body Burden
Current (1984) status of the study of ^{226}Ra and ^{228}Ra in humans at the Center for Human Radiobiology, 9:50608 (R;US)
Radioecological Concentration
Uranium series disequilibrium measurements at MOL and Whiteshell. Annual progress report for 1983, 9:49530 (R;GB)
RADIUM D
See LEAD 210
RADIUM F
See POLONIUM 210
RADON
Indoor Air Pollution
Dose estimation by simultaneous measurement of the radon/thoron concentration and the equilibrium factors in air using a passive dosemeter, 9:50480 (R;DE;In German)
RADON 222
Autoradiography
Feasibility of the use of nuclear-emulsion techniques in the study of drill core and water samples from the Monticello mill, Monticello, Utah, 9:49568 (R;US)
Radioecological Concentration
Methods and results of EPA's study of radon in drinking water, 9:50576 (R;US)
RADON 226
Autoradiography
Feasibility of the use of nuclear-emulsion techniques in the study of drill core and water samples from the Monticello mill, Monticello, Utah, 9:49568 (R;US)
RADON MONITORS
See EMANOMETERS
RAIN WATER
PH Value
Peroxyacetyl nitrate solubility and decomposition rate in acidic water, 9:50574 (J;GB)
RAMAN EFFECT
Time Dependence
Time-resolved resonant Raman scattering and hot luminescence at the 1S ortho-exciton in Cu_2O, 9:50747 (R;US)
RANKINE CYCLE POWER SYSTEMS
Computer Calculations
Low-temperature heat utilization in production of electric or mechanical power Organic Rankine Cycle System. Part-report comprehending instrumentation and computer measurement program, 9:50440 (R;DK;In Danish)
Performance
Low-temperature heat utilization in production of electric or mechanical power Organic Rankine Cycle System. Part-report comprehending instrumentation and computer measurement program, 9:50440 (R;DK;In Danish)
RARE EARTH COMPOUNDS
See also LANTHANUM COMPOUNDS
Physical Properties
Existence and structure of rare earth monocarbides: study of their magnetic properties at low temperatures, 9:50171 (TG;US)
RAWALPINDI RESEARCH REACTOR
See PARR REACTOR
REACTOR ACCIDENTS
See also LOSS OF COOLANT
LOSS OF FLOW
MELTDOWN
REACTOR CORE DISRUPTION
TRANSIENT OVERPOWER ACCIDENTS
After-Heat
Review of areas that may require simultaneous coupled solution of the thermal hydraulic and fission product/aerosol

behavior equations for source term determination (PWR; BWR), 9:49853 (R;US)

Cooling
Design features to enhance debris bed coolability, 9:49851 (R;US)

Fission Product Release
Review of areas that may require simultaneous coupled solution of the thermal hydraulic and fission product/aerosol behavior equations for source term determination (PWR; BWR), 9:49853 (R;US)

Fuel Cans
Raman and luminescence spectroscopy of zirconium oxide with the use of the MOLE microprobe, 9:49854 (R;US)

Molten Metal-Water Reactions
Experiment for triggered fragmentation with a molten copper-drop in water, 9:50401 (R;DE;In German)

Pipes
Pipe to pipe impact, 9:49898 (R;US)

Probability
Probability of pipe failure in the reactor coolant loops of Combustion Engineering PWR plants. Volume 2. Pipe failure induced by crack growth, 9:49890 (R;US)

Radiant Heat Transfer
Geometric radiation exchange factors for axial radiative transfer in an LWR core filled with absorbing-emitting gases, 9:49852 (R;US)

Radioactive Aerosols
DEMONA - research program for the demonstration of nuclear aerosol behaviour, 9:49872 (R;DE;In German)

REACTOR CHANNELS
Passage through the reactor.

Incompressible Flow
Flow in a channel with fluid bleed through lateral walls, 9:50400 (R;SU;In Russian)

Laminar Flow
Flow in a channel with fluid bleed through lateral walls, 9:50400 (R;SU;In Russian)

REACTOR COMPONENTS
See also CONTROL ELEMENTS
CONTROL ROD DRIVES
CORE CATCHERS
FUEL ELEMENTS
REACTOR CHANNELS
REACTOR CORES

Acoustic Emission Testing
Acoustic emission monitoring of ZB 1 intermediate scale vessel test, 9:49808 (RA;DE)

Acoustic Monitoring
Vibroacoustic diagnostic system, 9:50412 (RA;CS;In Czech)

Cost
Trends in the development of new pipe systems for power plants, 9:49856 (RA;DE;In German)

Cracks
Assessment of cracks in components of nuclear power plants, 9:49813 (RA;DE;In German)

Fabrication
New fabrication techniques for components-fabrication demands and in-service reliability, 9:49810 (RA;DE;In German)
Trends in the development of new pipe systems for power plants, 9:49856 (RA;DE;In German)

In-Service Inspection
Emerging technology of synthetic aperture focusing for ultrasonic testing, 9:49814 (R;US)

Manufacturing
Manufacturing of ultra-large diameter 20 MnMoNi 5 5 steel forgings for reactor pressure vessels and their properties, 9:50116 (RA;DE)

Meetings
Diagnostics of nuclear power plant components. Proceedings of a national seminar, 9:49812 (R;CS)

Nondestructive Testing
Detection and analysis of residual- and loading stresses in thick-walled components. State of research and development of the nondestructive methods, 9:49807 (RA;DE;In German)

REACTOR CONTROL RODS
See CONTROL ELEMENTS

REACTOR CONTROL SYSTEMS

Computerized Simulation
Hybrid model of reactor neutron power control, 9:49820 (RA;CS;In Czech)

Design
Instrumentation and Controls evaluation for space nuclear power systems, 9:49817 (R;US)

Energy Yield
Computer-aided core surveillance: a conceptual study for WWER type reactors, 9:49825 (RA;BG;In Bulgarian)

REACTOR CONTROL THEORY
See REACTOR KINETICS

REACTOR CORE DISRUPTION

Reactor Safety Experiments
Causes of larger degraded core frequencies in earlier safety studies compared with Sizewell 'B', 9:49900 (R;GB)

REACTOR CORES

Criticality
710 reactor program. Progress report No. 17, 9:49784 (R;US)
Criticality experiments of the years 1981 and 1982, 9:49796 (R;DE;In German)

Neutron Flux
Benchmark calculations for MTR type cores, 9:49841 (R;PK)

Reactivity
Benchmark calculations for MTR type cores, 9:49841 (R;PK)

Thermal Conductivity
Effective thermal conductivity in packed beds of spheres especially in the core of a high temperature reactor, 9:49780 (R;DE;In German)

REACTOR DECOMMISSIONING

Financing
Utility financial stability and the availability of funds for decommissioning, 9:49787 (R;US)

REACTOR FUEL ELEMENTS
See FUEL ELEMENTS

REACTOR FUELS
See NUCLEAR FUELS

REACTOR INSTRUMENTATION

Data Acquisition Systems
Measurement and evaluation system for in-core experiments, 9:49821 (RA;CS;In Czech)

Design
Instrumentation and Controls evaluation for space nuclear power systems, 9:49817 (R;US)

REACTOR KINETICS

Computer Codes
SKINATH - a computer program for solving the reactor point kinetics equations with simple thermal-hydraulic feedback, 9:49801 (R;US)

Computerized Simulation
Hybrid model of reactor neutron power control, 9:49820 (RA;CS;In Czech)

REACTOR LICENSING

Document Types
Nuclear Regulatory Commission issuances, June 1984. Volume 19, No. 6, 9:49786 (R;US)

REACTOR MATERIALS
To be assigned in conjunction with the specific descriptor for the material used in a reactor, provided this descriptor is not yet up-posted to reactor materials.
See also NUCLEAR FUELS

Comparative Evaluations
Evaluation of low-cobalt alloys for hardfacing applications in nuclear components. Final report, 9:49803 (R;US)

Crack Propagation
Influence of material toughness on damage caused by thermal shock loading, 9:49805 (RA;DE;In German)

Fracture Properties
Application and evaluation of post-yield fracture mechanics concepts for cracked vessels, 9:49809 (RA;DE;In German)
Influence of material toughness on damage caused by thermal shock loading, 9:49805 (RA;DE;In German)
Some aspects on leak before break; their quantification and application, 9:49806 (RA;DE)

Performance Testing
710 reactor program. Progress report No. 17, 9:49784 (R;US)

Quality Assurance
Some aspects on leak before break; their quantification and application, 9:49806 (RA;DE)
Thermal Shock
Crack growth under cyclic thermal shock loading, 9:49804 (RA;DE;In German)
Influence of material toughness on damage caused by thermal shock loading, 9:49805 (RA;DE;In German)

REACTOR OSCILLATORS
Research Programs
Scientific work of Leonardo Caldarola, 9:49884 (R;DE;In German)

REACTOR PHYSICS
Use only for indexing articles of very broad coverage, such as annual reviews, text book, etc.
Iterative Methods
Method for convergence acceleration of iterative solutions of eigenvalue-problems in reactor theory and implementation in the DIFGEN-code, 9:49798 (R;DE;In German)

REACTOR PROTECTION SYSTEMS
Fault Tree Analysis
Automatic construction of failure tree for reliability analysis of nuclear power plants, 9:49858 (RA;CS;In Slovak)

REACTOR SAFETY
Containment Buildings
EPRI research on hydrogen combustion and control, 9:49866 (RA;DE)
Environment
Radioecological research on the behavior of actinides in the environment, 9:49870 (RA;DE;In German)
Kernforschungszentrum Karlsruhe
Annual report 1983 of Hauptabteilung Sicherheit, 9:49874 (R;DE;In German)
Meetings
Proceedings of the 1982 annual colloquium of the Project Nuclear Safety, 9:49862 (R;DE;In German)
Proceedings of the 1983 annual colloquium of the Project Nuclear Safety, 9:49875 (R;DE;In German)
Research Programs
Light water reactor hydrogen safety research in the United States, 9:49865 (RA;DE)
Proceedings of the 1983 annual colloquium of the Project Nuclear Safety, 9:49875 (R;DE;In German)
Scientific work of Leonardo Caldarola, 9:49884 (R;DE;In German)
Status of the reactor safety research in the Project Nuclear Safety, 9:49864 (RA;DE;In German)
Status of the reactor safety research in the Project Nuclear Safety, 9:49878 (RA;DE;In German)
U.S.N.R.C. research on severe accidents and other safety matters, 9:49863 (RA;DE)
Risk Assessment
Impact of risk studies, 9:49936 (R;SE)
Test Facilities
BWR Full Integral Simulation Test (FIST) program: facility description report, 9:49889 (R;US)

REACTOR SAFETY EXPERIMENTS
Experimental investigation of post dryout heat transfer, 9:49885 (R;SE)

REACTOR SIMULATORS
Nuclear Plant Analyzer: an interactive TRAC/RELAP Power-Plant Simulation Program, 9:49886 (R;US)

REACTORS
See also POWER REACTORS
PROCESS HEAT REACTORS
RESEARCH AND TEST REACTORS
WATER COOLED REACTORS
Dosimetry
LSL-M1 and LSL-M2: two extensions of the LSL adjustment procedure for including multiple spectrum locations, 9:49797 (R;US)

RECEIVERS (SOLAR)
See SOLAR RECEIVERS

RECLAMATION
See LAND RECLAMATION

RECORDING SYSTEMS
Optical Systems
Photonic methods of high speed analog data recording, 9:50501 (R;US)

REFLECTIVE COATINGS
Damage
Alumina/silica multilayer coatings for excimer lasers, 9:50395 (R;US)

REFRACTORY METAL COMPOUNDS
See also NIOBIUM COMPOUNDS
RUTHENIUM COMPOUNDS
Chemical Preparation
Synthesis of refractory materials, 9:50165 (P;US)

REFRIGERANTS
Flow Rate
Air heat source heat pump chiller with a new refrigerant flow rate control, 9:50026 (TJ;US)

REFRIGERATING MACHINERY
Control Systems
Wide-range, high-efficiency control system for the refrigeration cycle, 9:50025 (TJ;US)

REFRIGERATORS
See also HELIUM DILUTION REFRIGERATORS
Computerized Control Systems
Control of the Tevatron Satellite Refrigeration system, 9:50470 (BA;US)

REFUSE
See SOLID WASTES

REFUSE-FUELED POWER PLANTS
Meetings
Proceedings: EPRI/TVA biomass workshop on the use of biomass for the generation of electric power, 9:49590 (R;US)

REGGE TRAJECTORIES
Bound State
Bound state Regge trajectories in N=8 supergravity, 9:50814 (BA;US)

REGION III
See FEDERAL REGION III

REGION X
See FEDERAL REGION X

REGRESSION ANALYSIS
Dependence of liquefaction behavior on coal characteristics. Part VI. Relationship of liquefaction behavior of a set of high sulfur coals to chemical structural characteristics. Final technical report, March 1981 to February 1984 , 9:49352 (R;US)
Particulate characterization, 9:49753 (RA;US)

RELATIVITY THEORY
Quantization
Quantum relativity theory, 9:50963 (R;HU)

RELEASE (FISSION PRODUCT)
See FISSION PRODUCT RELEASE

RELIABILITY
Meetings
Experts' meeting: Maintenance '83. Maintenance and reliability, 9:50368 (R;DE;In German)

REMOTE HANDLING EQUIPMENT
See also MANIPULATORS
Cameras
Automatic camera tracking for remote manipulators, 9:49516 (R;US)
Design
Conceptual design report for a remotely operated cask handling system. Revision 1, 9:50367 (R;US)

RENEWABLE ENERGY SOURCES
See also BIOMASS
GEOTHERMAL ENERGY
HYDROELECTRIC POWER
SOLAR ENERGY
WIND POWER
Commercialization
What alternate supply options (besides coal) are proving practical, 9:49600 (RA;US)
Feasibility Studies
What alternate supply options (besides coal) are proving practical, 9:49600 (RA;US)

Financial Incentives
Post-war energy economics: the urban and regional implications, 9:49921 (RA;US)
Research Programs
Current alternative energy research and development in Illinois, 9:49959 (R;US)
Technology Assessment
What alternate supply options (besides coal) are proving practical, 9:49600 (RA;US)

RESEARCH AND TEST REACTORS
Nuclear Fuels
RERTR Program: goals, progress and plans (Reduced Enrichment Research and Test Reactor), 9:49834 (R;US)

RESEARCH PROGRAMS
To be used jointly with descriptor(s) for subject field and/or organization concerned.
Budgets
High energy physics facilities. Hearing before the Subcommittee on Energy Development and Applications of the Committee on Science and Technology, US House of Representatives, Ninety-Eighth Congress, First Session, October 19, 1983, 9:50761 (B;US)

RESERVOIR FLUIDS
Chemical Composition
Apparatus for recovering gaseous hydrocarbons from hydrocarbon-containing solid hydrates, 9:49483 (P;US)

RESERVOIR ROCK
Flow Models
Gas injection in heterogeneous reservoirs. Analytical solution No. 1, 9:49450 (R;NO)
Gas injection in heterogeneous reservoirs. Case study No. 1, 9:49451 (R;NO)
Fractures
Model for fracture genesis: application to Mesaverde group, Piceance Creek basin, Colorado, 9:49476 (J;US)
Permeability
Model for fracture genesis: application to Mesaverde group, Piceance Creek basin, Colorado, 9:49476 (J;US)
Resource Potential
Facies relationships and reservoir potential of Ohio Creek interval across Piceance Creek basin, northwestern Colorado, 9:49445 (J;US)

RESIDENCES
See HOUSES

RESIDENTIAL BUILDINGS
See also APARTMENT BUILDINGS
HOUSES
Energy Conservation
Assessment of how residential passive solar systems impact utilities. Final report, 9:49686 (R;US)
Don't pay for insulation: buy conservation, 9:49985 (RA;US)
Home energy rating system, 9:49987 (RA;US)
Hood River Conservation Project, 9:49989 (RA;US)
Measuring the impact of residential conservation programs: a case study, 9:49984 (RA;US)
Operation wrap-up/seal-up; an inside look, 9:49990 (RA;US)
Utility financing of energy management: the Puget Sound Power and Light experience, 9:49986 (RA;US)
Energy Demand
Assessment of how residential passive solar systems impact utilities. Final report, 9:49686 (R;US)
Energy Efficiency Standards
Impact analysis speculations regarding the Pacific Northwest Power Planning Council prescriptive building standards applied to the public utilities service area new housing starts, 9:49980 (R;US)
Furnaces
Small coal furnaces: the neglected option, 9:49425 (RA;US)
Heating Load
House thermal envelope conservation optimization with respect to performance/economics, 9:49968 (R;US)
Life-Cycle Cost
Life-cycle cost analysis project. Final report, 9:50001 (R;US)
Passive Solar Heating Systems
Assessment of how residential passive solar systems impact utilities. Final report, 9:49686 (R;US)
Photovoltaic Power Supplies
Progress at the Southwest Residential Experiment Station, 9:49661 (BA;US)
Power Demand
Residential load forecasting: intergrating end-use and econometric methods, 9:49983 (RA;US)
Solar Space Heating
Characterization of representative air and liquid-type collectors for solar economic analysis in residences, 9:49698 (BA;US)
Solar Water Heating
Characterization of representative air and liquid-type collectors for solar economic analysis in residences, 9:49698 (BA;US)
Space Heating
Energy: challenges and opportunities for the Middle Atlantic United States. Volume 2. Background articles, 9:49917 (R;US)
Thermal Insulation
House thermal envelope conservation optimization with respect to performance/economics, 9:49968 (R;US)
Ventilation
Review of recent research in indoor air quality. Final report October 1983-February 1984, 9:50533 (R;US)
Weatherization
Building retrofit innovations. Final technical report, 9:49982 (R;US)
Hood River Conservation Project, 9:49989 (RA;US)
Operation wrap-up/seal-up; an inside look, 9:49990 (RA;US)

RESIDENTIAL SECTOR
Energy Consumption
Adapting state and national electricity consumption forecasting methods to utility service areas. Final report, 9:49956 (R;US)
Energy Expenses
Appendices A, B, and C of the methodology for life cycle cost analysis using average fuel costs, 9:49955 (R;US)
Photovoltaic Power Plants
Residential photovoltaic power conditioning technology for grid connected applications, 9:49662 (BA;US)
Weatherization
Conservation's value varies with view, 9:50024 (J;US)

RESIDUAL FUEL OIL
See RESIDUAL FUELS

RESIDUAL FUELS
Data Compilation
Petroleum supply monthly, July 1984, 9:49454 (R;US)
Prices
State Energy Price System: 1982 update, 9:49952 (R;US)
Sales
Petroleum marketing monthly, July 1984, 9:49455 (R;US)

RESIDUES (RADIOACTIVE)
See RADIOACTIVE WASTES

RESIDUUMS
See RESIDUAL FUELS

RESINS
Molding
Method and composition for molding low density desiccant syntactic foam articles, 9:50180 (P;US)

RESOURCE DEVELOPMENT
Legal Aspects
Consistency: current issues, 9:49468 (R;US)

RESOURCE RECOVERY FACILITIES
Particle Size Classifiers
Zigzag configurations and air classifier performance, 9:50430 (J;US)

RESPIRATORY SYSTEM DISEASES
See also PNEUMOCONIOSES
Radioinduction
Computer code for general analysis of radon risks (GARR), 9:50615 (R;US)

RETORTED SHALES
See SPENT SHALES

RETORTS
Design
Battelle's Multi-Solid Fluidized Bed Oil Shale Retort, 9:49498 (BA;US)
Combined fluidized bed retort and combustor, 9:49497 (P;US)

Operation
Combined fluidized bed retort and combustor, 9:49497 (P;US)
Research Programs
Battelle's Multi-Solid Fluidized Bed Oil Shale Retort, 9:49498 (BA;US)
RF SYSTEMS
Attenuation
High power radio frequency attenuation device, 9:50425 (P;US)
Frequency Control
High power radio frequency attenuation device, 9:50425 (P;US)
Resistors
High power radio frequency attenuation device, 9:50425 (P;US)
RHENIUM
Work Functions
Edge states and quantized Hall conductivity in a periodic potential, 9:50144 (J;US)
RHENIUM ALLOYS
Thermal Stresses
710 reactor program. Progress report No. 17, 9:49784 (R;US)
RHODAMINES
Fluorescence
Concerning the question of the fluorescence yield of solutions, 9:50328 (TJ;US)
RHODIUM HYDRIDES
Physical Properties
Properties and thermal stabilities of amorphous transition metal hydrides (Zr_3PdH_x; Zr_3RhH_x), 9:50163 (R;US)
RIDESHARING
See CARPOOLING
RING LASERS
Design
Fourier-transform ring laser, 9:50397 (J;US)
RINGS (STORAGE)
See STORAGE RINGS
RISER CRACKING
See COAL LIQUEFACTION
RISK ASSESSMENT
Comparative Evaluations
Putting risk analysis into perspective: a comparative review of major societal risk studies of nuclear power, 9:49935 (R;SE)
Human Factors
Process evaluation of the human reliability data bank, 9:49937 (R;US)
RIVERS
Floods
Floods on Duck River in the vicinity of Centerville, Tennessee, 9:50661 (R;US)
RNA POLYMERASE
See POLYMERASES
RO-07-0582
See MISONIDAZOLE
ROAD TESTS
Simulation
Energy characteristics of road vehicles represented by the example of an electric transporter, 9:50085 (R;DE;In German)
ROBOTS
Remote Control
Filling the gap through teleoperation, 9:50495 (R;US)
ROCK SALT
See SALT DEPOSITS
ROCKS
See also SEDIMENTARY ROCKS
Mechanical Properties
Geologic factors in coal mine roof stability--a progress report. Information circular/1984 (Effects of moisture), 9:49416 (R;US)
RODS (CONTROL)
See CONTROL ELEMENTS
RODS (FUEL)
See FUEL RODS
ROOFS
Roof Bolts
Geologic factors in coal mine roof stability--a progress report. Information circular/1984 (Effects of moisture), 9:49416 (R;US)
Stability
Geologic factors in coal mine roof stability--a progress report. Information circular/1984 (Effects of moisture), 9:49416 (R;US)
Supports
Geologic factors in coal mine roof stability--a progress report. Information circular/1984 (Effects of moisture), 9:49416 (R;US)
ROOM AND PILLAR MINING
Explosive Fracturing
Fracture control blasting techniques for oil shale mining, 9:49495 (BA;US)
RUBBERS
Poisson Ratio
Effect of pressure on the mechanical properties of polymers. Part II. Measurement of the time-dependent Poisson's ratio. Final report, 9:50177 (R;US)
RUBIDIUM
Absorption Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Activation Analysis
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Electronic Structure
Calorimetric investigation into the possibility of a charge density wave ground state in alkali metals, 9:50133 (R;US)
Emission Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Specific Heat
Calorimetric investigation into the possibility of a charge density wave ground state in alkali metals, 9:50133 (R;US)
RUTHENIUM COMPLEXES
Chemical Reaction Kinetics
Ground- and excited-state electron-transfer reactions: photoinduced redox reactions of poly(pyridine)ruthenium(II) complexes and cobalt(III) cage compounds, 9:50336 (J;US)
Redox Reactions
Ground- and excited-state electron-transfer reactions: photoinduced redox reactions of poly(pyridine)ruthenium(II) complexes and cobalt(III) cage compounds, 9:50336 (J;US)
RUTHENIUM COMPOUNDS
Catalytic Effects
Studies relevant to the catalytic activation of carbon monoxide: the water gas shift reaction and related processes. Technical progress report, December 1, 1983-November 30, 1984, 9:49330 (R;US)
RUTILE
Atom Transport
Diffusion of deuterium and hydrogen in rutile TiO_2 crystals at low temperatures, 9:50208 (J;US)
Chemical Bonds
Diffusion of deuterium and hydrogen in rutile TiO_2 crystals at low temperatures, 9:50208 (J;US)
Infrared Spectra
Diffusion of deuterium and hydrogen in rutile TiO_2 crystals at low temperatures, 9:50208 (J;US)
RYE
Chemical Analysis
Lead uptake by perennial ryegrass and radishes from air, water and soil, 9:50650 (J;CA)

S

S PROCESS
Dynamic stellar neutron-capture nucleosynthesis: the need for more nuclear data for the s-process, 9:50703 (R;US)

SAFETY
For general aspects of safety and protection of personnel.
See also OCCUPATIONAL SAFETY
REACTOR SAFETY
Regulations
Safety analysis and review system (SARS), 9:49932 (R;US)
SAFETY (NUCLEAR)
See RADIATION PROTECTION
SAFETY (REACTOR)
See REACTOR SAFETY
SALICYLIC ACID
Biological Effects
Chelation and effectiveness of salicylate related compounds on pyresis, sedimentation rate and hematocrit, 9:50633 (R;US)
SALINE ZONE
See OIL SHALES
PICEANCE CREEK BASIN
SALT DEPOSITS
Chemical Analysis
Summary of petrographic and chemical data for Palo Duro Basin samples examined by Bendix Field Engineering Corporation, Grand Junction, Colorado, as of April 29, 1983, 9:49538 (R;US)
Creep
Transient creep of repository rocks. Mechanistic creep laws for rock salt. Final report, 9:50665 (R;US)
Petrography
Summary of petrographic and chemical data for Palo Duro Basin samples examined by Bendix Field Engineering Corporation, Grand Junction, Colorado, as of April 29, 1983, 9:49538 (R;US)
Radioactive Waste Disposal
Performance assessment plans and methods for the Salt Repository Project (Contains glossary), 9:49539 (R;US)
SAMARIUM 149
Energy Levels
Opposing properties of particle-hole and intruder-hole bands in N = 87 nuclei and ^{149}Sm levels populated by ^{149}Pm (β^-) and ^{149}Eu(EC), 9:50881 (J;GB)
SAMARIUM 154 TARGET
Nitrogen 14 Reactions
Localized l window from partial fusion reactions accompanied by proton, deuteron, and triton emission, 9:50887 (RA;AU)
Partial fusion reaction and its application to high-spin spectroscopy, 9:50890 (RA;AU)
SAMPLERS
See also AIR SAMPLERS
Design
Downhole sampling of geopressured gas wells. Final report, June 1982-July 1984, 9:49477 (R;US)
Performance Testing
Downhole sampling of geopressured gas wells. Final report, June 1982-July 1984, 9:49477 (R;US)
SAMPLING
Quality Control
Soil sampling quality assurance user's guide, 9:50552 (R;US)
SANDSTONES
Directional Drilling
Feasibility study: vertical fracturing in directionally drilled wells. Final report, January 1983-September 1983, 9:49482 (R;US)
Hydraulic Fracturing
Feasibility study: vertical fracturing in directionally drilled wells. Final report, January 1983-September 1983, 9:49482 (R;US)
Permeability
Stratigraphically controlled gas production from Abo red beds (Permian), east-central New Mexico, 9:49475 (R;US)
Porosity
Stratigraphically controlled gas production from Abo red beds (Permian), east-central New Mexico, 9:49475 (R;US)
SANITARY LANDFILLS
Leaching
Waste disposal sites and their effect on the quality of ground water: a study of literature, 9:50570 (R;NL;In Dutch)
Monitoring
Vadose zone monitoring for hazardous waste sites, 9:50553 (R;US)
SATELLITES
Radiation Doses
TOPEX orbital radiation study, 9:50695 (R;US)
SAVANNAH RIVER PLANT
Savannah River Laboratory monthly report, June 1984 (Defense waste management, reactor technology, separations, environment), 9:49517 (R;US)
Radioactive Waste Management
Waste Management Program. Technical progress report, July-September 1983, 9:49549 (R;US)
SAVANNAH RIVER PLANT L REACTOR
See L REACTOR
SCALE CONTROL
Technology Assessment
Monitoring technology trends with patent data: fouling of heat exchangers. A case study, 9:50061 (R;US)
SCANDIUM
Absorption Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Activation Analysis
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Emission Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
SCATTERING
Center-of-Mass System
Transformation of angular scattering probabilities between reference systems: survey and numerical analysis, 9:50827 (R;XN)
Laboratory System
Transformation of angular scattering probabilities between reference systems: survey and numerical analysis, 9:50827 (R;XN)
SCHIFF BASES
Excitation
Spectral properties of protonated Schiff base porphyrins and chlorins. INDO-CI calculations and resonance raman studies, 9:50337 (J;US)
Structural Chemical Analysis
Spectral properties of protonated Schiff base porphyrins and chlorins. INDO-CI calculations and resonance raman studies, 9:50337 (J;US)
SCHOOL BUILDINGS
Heat Losses
Remote sensing survey of energy losses from public buildings. Final report, 9:50002 (R;US)
Infrared Thermography
Remote sensing survey of energy losses from public buildings. Final report, 9:50002 (R;US)
SCHWINGER SOURCE THEORY
Topology
Quantum effects in the Schwinger model, 9:50804 (RA;BG;In Bulgarian)
SCINTILLATION COUNTING
Sensitivity
Gamma-spectrometrical measurements in-situ of natural waters in Bulgaria, 9:50578 (RA;BG;In Bulgarian)
SCOTTISH RESEARCH REACTOR CENTER UTR-100
See SRRC-UTR-100 REACTOR
SCRUBBERS
See also DRY SCRUBBERS
Performance Testing
Performance of gas-atomized spray scrubbers at high pressure (1-10 Atm), 9:49402 (J;US)
SEA BED
Permeability
Remote assessment of permeability/thermal diffusivity of consolidated clay sediments, 9:49551 (R;GB)
Thermal Diffusion
Remote assessment of permeability/thermal diffusivity of consolidated clay sediments, 9:49551 (R;GB)

SEAS
Radionuclide Migration
Oceanographic model for the dispersion of wastes disposed of in the deep sea, 9:50577 (R;XA)
Upwelling
An artificial upwelling driven by salinity differences in the ocean, 9:49679 (BA;US)
SEAWATER
Influence of adsorber performance on plant design for the extraction of uranium from seawater, 9:49508 (R;DE)
X-Ray Fluorescence Analysis
Development of an analytical procedure for the determination of traces of dissolved heavy metals in seawater by means of total reflection X-ray fluorescence analysis, 9:50266 (R;DE;In German)
SECALE
See RYE
SECONDARY BATTERIES
See ELECTRIC BATTERIES
SECONDARY COOLANT CIRCUITS
Fault Tree Analysis
Reliability analysis of selected systems of nuclear power unit, 9:49774 (RA;CS;In Czech)
SECURITY SEALS
Electronic Equipment
Joint US-German evaluation of electronic safeguards seal systems, 9:49570 (R;DE)
SEDIMENTARY ROCKS
See also CARBONATE ROCKS
SANDSTONES
Meetings
Sedimentology 82: Abstracts. Sedimentology applied to exploration, mining, engineering and environmental studies, 9:50659 (R;ZA)
SEDIMENTS
Meetings
Radioisotopes in sediment studies. Report of a consultants' group meeting organized by the IAEA and held in Vienna, 13-17 December 1982, 9:50657 (R;XA)
Scintillation Counting
Joint comparative research on gamma-ray emitting radionuclides in samples from the Danube-Black Sea territorial complex, 9:50559 (RA;BG;In Bulgarian)
Tracer Techniques
Preparation of radioactive tracer for studying sediment movement, 9:50668 (R;PK)
SELENIUM
Annealing
Electron beam processing of semiconductors, 9:50242 (BA;NL)
Ion Implantation
Electron beam processing of semiconductors, 9:50242 (BA;NL)
Recrystallization
Electron beam processing of semiconductors, 9:50242 (BA;NL)
SEMICONDUCTOR DEVICES
See also SEMICONDUCTOR LASERS
THYRISTORS
Fabrication
Electrical characteristics and device applications of zone-melting-recrystallized Si films on SiO_2, 9:50231 (BA;NL)
Processing of shallow (Rp<150 /SUP o/ A) implanted layers with electron beams, 9:50238 (BA;NL)
SEMICONDUCTOR LASERS
Resonators
Locking of diode gain modules using optical conjugation techniques. Final report 1 August 1982-30 September 1983, 9:50392 (R;US)
SEMICONDUCTOR MATERIALS
If possible index also the specific compounds.
Carrier Density
Electron-hole plasma formation in semiconductors due to the absorption of pulsed CO_2 laser light, 9:50944 (R;US)
Electron-Hole Droplets
Electron-hole plasma formation in semiconductors due to the absorption of pulsed CO_2 laser light, 9:50944 (R;US)
Heat Transfer
Temperature profiles induced by strip heaters, 9:50248 (BA;NL)
Ion Implantation
Amorphous materials and recrystallization, 9:50420 (R;US)
Ion Microprobe Analysis
Helium microprobe analysis at Melbourne of semiconductor materials, 9:50282 (RA;AU)
Isotherm
Temperature profiles induced by strip heaters, 9:50248 (BA;NL)
Nonlinear Optics
Infrared nonlinear processes in semiconductors. Final technical report 1 October 1979-30 November 1983, 9:50389 (R;US)
Temperature Distribution
Temperature profiles induced by strip heaters, 9:50248 (BA;NL)
Transmission Electron Microscopy
Transmission electron microscopy of inorganic materials, 9:50092 (R;US)
SENIOR CENTERS
See PUBLIC BUILDINGS
SENSIBLE HEAT STORAGE
Phase Change Materials
Composite latent/sensible energy storage media for high-temperature industrial applications, 9:49905 (R;US)
Porous Materials
Composite latent/sensible energy storage media for high-temperature industrial applications, 9:49905 (R;US)
SENSITIZERS
Catalytic Effects
Singlet sensitization of the norbornadiene rearrangement: excitation energy cascade potentially involving triplet exciplexes (2-methoxynaphthalene, 2,6-dimethoxynaphthalene, phenanthrene, chrysene, ClO_2, pyrene, 9,10-dimethylanthracene, 1,4-dimethoxyanthracene), 9:50345 (J;GB)
SEPARATION NOZZLE METHOD
Nozzles
Accuracy of X-ray lithography using synchrotron radiation for the fabrication of technical separation nozzle elements, 9:49511 (R;DE;In German)
Operation
Investigations into the operating behavior of separation nozzle cascades for uranium-235 enrichment in a 10-stage pilot plant, 9:49510 (R;DE;In German)
SEPARATION PROCESSES
See also FILTRATION
Data Analysis
Separation factor method for the analysis of ideal binary mixtures in gas-solid adsorption, 9:50293 (J;US)
SHAFTS
Rotation
Rotary shaft seal, 9:50428 (P;US)
Seals
Rotary shaft seal, 9:50428 (P;US)
SHALE MINING
See OIL SHALE MINING
SHALE OIL
Chemical Composition
Nitrogen compound distribution in Eastern and Western U.S. shale oils produced by hydropyrolysis, 9:49503 (BA;US)
Structural Chemical Analysis
Nitrogen compound distribution in Eastern and Western U.S. shale oils produced by hydropyrolysis, 9:49503 (BA;US)
SHEATHS (FUEL)
See FUEL CANS
SHEEP
Body Composition
Measurement of lean body mass in animals by thermal neutron capture gamma-ray analysis, 9:50280 (RA;AU)
SHIELDING MATERIALS
Neutron Transport
Theoretical and experimental investigation on neutron transport in moderating and shielding materials, 9:50930 (RA;BG;In Bulgarian)

SHIFT PROCESSES
Bench-Scale Experiments
Development of an advanced water-gas shift conversion system. Monthly project status report No. 6, September 1-30, 1984, 9:49357 (R;US)
Catalysts
Development of an advanced water-gas shift conversion system. Monthly project status report No. 6, September 1-30, 1984, 9:49357 (R;US)
Hydrogen production from low-rank coals, 9:49332 (RA;US)
Studies relevant to the catalytic activation of carbon monoxide: the water gas shift reaction and related processes. Technical progress report, December 1, 1983-November 30, 1984, 9:49330 (R;US)
Chemical Reactors
Development of an advanced water-gas shift conversion system. Monthly project status report No. 6, September 1-30, 1984, 9:49357 (R;US)
Chemistry
Studies relevant to the catalytic activation of carbon monoxide: the water gas shift reaction and related processes. Technical progress report, December 1, 1983-November 30, 1984, 9:49330 (R;US)
Research Programs
Studies relevant to the catalytic activation of carbon monoxide: the water gas shift reaction and related processes. Technical progress report, December 1, 1983-November 30, 1984, 9:49330 (R;US)
SHOREHAM REACTOR
Shoreham, New York, USA
Reactor Safety
Safety evaluation report related to the operation of Shoreham Nuclear Power Station, Unit No. 1 (Docket No. 50-322). Supplement No. 7, 9:49887 (R;US)
SHORT ROTATION CULTIVATION
Environmental Impacts
Forest nutrient cycles as affected by climate, species composition, stand age, and intensive harvesting, 9:49605 (R;US)
SHORTITE
Hot-gas chloride cleanup for molten carbonate fuel cells, 9:49339 (RA;US)
SHOWER COUNTERS
Detects high energy gamma radiation or high energy particles on basis of cascade showers in layered absorbers.
Cascade Showers
Hadron-lepton cascade calculations (1-20 GeV) for a Pb-Al-lucite calorimeter, 9:50484 (R;US)
SHUNT REACTORS
Design
Capacitively-coupled inductive sensor, 9:50429 (P;US)
Magnet Cores
Laminated grid and web magnetic cores, 9:50385 (P;US)
SIALON
See ALUMINIUM OXIDES
SILICON NITRIDES
SIGMA MINUS
Semileptonic Decay
Consistency between two recent experiments on $\Sigma p \rightarrow ne\nu$, 9:50771 (J;US)
SILICA
Solubility
High temperature aqueous solutions and energy considerations - physical chemical studies, 9:50298 (R;US)
SILICATES
See also ALUMINIUM SILICATES
Fluctuations
Temporal and spatial variability of phytoplankton in a subtropical ecosystem, 9:50565 (J;US)
SILICEOUS ROCK
See SANDSTONES
SILICON
Annealing
Aligned, coexisting liquid and solid regions in pulsed and cw laser annealing of Si, 9:50219 (BA;NL)
Analysis of temperature and stress profiles induced by a CW line scanned electron beam in <100> oriented silicon, 9:50249 (BA;NL)
Beam processing of silicon with a scanning CW Hg lamp, 9:50236 (BA;NL)
Crystallization of amorphous silicon films by pulsed ion beam annealing, 9:50233 (BA;NL)
Electron beam processing of semiconductors, 9:50242 (BA;NL)
Flame annealing of ion implanted silicon, 9:50240 (BA;NL)
Impurity distribution profiles and surface disorder after laser induced diffusion, 9:50222 (BA;NL)
Impurity redistribution in ion implanted Si after picosecond Nd laser pulse irradiation, 9:50221 (BA;NL)
Interferometric measurements of surface properties during laser annealing, 9:50251 (BA;NL)
Ising model simulations of impurity trapping in silicon, 9:50217 (BA;NL)
Isothermal annealing of ion implanted silicon with a graphite radiation source, 9:50237 (BA;NL)
Laser-induced surface defects, 9:50252 (BA;NL)
Microprobe Raman analysis of picosecond laser annealing of implanted silicon, 9:50218 (BA;NL)
Picosecond laser-induced surface transformations in solids, 9:50253 (BA;NL)
Processing of shallow (Rp<150 /SUP o/ A) implanted layers with electron beams, 9:50238 (BA;NL)
Pulsed electron beam annealing induced deep level defects in virgin silicon, 9:50232 (BA;NL)
Selective laser annealing for device processing, 9:50235 (BA;NL)
Surface studies of laser annealed semiconductors, 9:50239 (BA;NL)
Transient annealing of ion-implanted silicon using a scanning IR line source, 9:50234 (BA;NL)
Chemical Bonds
Charged dangling bonds and crystallization in group IV semiconductors, 9:50245 (BA;NL)
Chlorination
Laboratory scale studies of $SiHCl_3$ synthesis, 9:50300 (R;TW;CH)
Coatings
Process-included topological changes of monocrystalline silicon plates, 9:50205 (R;DE;In German)
Crystal Defects
Flame annealing of ion implanted silicon, 9:50240 (BA;NL)
Studies of hydrogenated amorphous silicon, 9:49627 (R;US)
Crystal Doping
Flame annealing of ion implanted silicon, 9:50240 (BA;NL)
Impurity diffusion in silicon annealed by semi-continuous laser, 9:50250 (BA;NL)
Selective laser annealing for device processing, 9:50235 (BA;NL)
Crystal Growth
Pulsed electron beam annealing induced deep level defects in virgin silicon, 9:50232 (BA;NL)
Crystallization
Aligned, coexisting liquid and solid regions in pulsed and cw laser annealing of Si, 9:50219 (BA;NL)
Amorphous Si, crystallization and melting, 9:50220 (BA;NL)
Charged dangling bonds and crystallization in group IV semiconductors, 9:50245 (BA;NL)
Crystallization of silicon films on glass: A comparison of methods, 9:50230 (BA;NL)
Explosive crystallization in a-Ge and a-Si: a review, 9:50243 (BA;NL)
Growth of silicon-on-insulator films using a line-source electron beam, 9:50228 (BA;NL)
Ising model simulations of impurity trapping in silicon, 9:50217 (BA;NL)
Laser-induced crystallization of silicon on bulk amorphous substrates: An overview, 9:50226 (BA;NL)
Laser-induced solid phase crystallization in amorphous silicon films, 9:50244 (BA;NL)
Lateral epitaxial growth of thick polysilicon films on oxidized 3-inch wafers, 9:50229 (BA;NL)
Selective laser annealing for device processing, 9:50235 (BA;NL)
Visualization of temperature profiles in a-Si crystallized in the explosive made by CW laser, 9:50246 (BA;NL)

Electric Conductivity
Conduction in polycrystalline silicon: generalized thermionic emission-diffusion theory and extended state mobility model, 9:50247 (BA;NL)
Electrical Properties
Conduction in polycrystalline silicon: generalized thermionic emission-diffusion theory and extended state mobility model, 9:50247 (BA;NL)
Electron Beam Melting
A comparison of CW laser and electron-beam recrystallization of polysilicon in multilayer structures, 9:50225 (BA;NL)
Electron Scanning
Analysis of temperature and stress profiles induced by a CW line scanned electron beam in <100> oriented silicon, 9:50249 (BA;NL)
Electron Spin Resonance
Studies of hydrogenated amorphous silicon, 9:49627 (R;US)
Films
Laser-induced solid phase crystallization in amorphous silicon films, 9:50244 (BA;NL)
Grain Orientation
Analysis of temperature and stress profiles induced by a CW line scanned electron beam in <100> oriented silicon, 9:50249 (BA;NL)
Impurities
Impurity diffusion in silicon annealed by semi-continuous laser, 9:50250 (BA;NL)
Interferometry
Interferometric measurements of surface properties during laser annealing, 9:50251 (BA;NL)
Ion Channeling
Impurity redistribution in ion implanted Si after picosecond Nd laser pulse irradiation, 9:50221 (BA;NL)
Resonant dechanneling of hundreds keV hydrogen and helium ions at axial-plane transitions in silicon, 9:50196 (RA;SU;In Russian)
Study of coherent precipitation of antimony in silicon using He^+ ion channeling and electron microscopy, 9:50191 (RA;AU)
Ion Implantation
Amorphous materials and recrystallization, 9:50420 (R;US)
Amorphous Si, crystallization and melting, 9:50220 (BA;NL)
Beam processing of silicon with a scanning CW Hg lamp, 9:50236 (BA;NL)
Crystallization of amorphous silicon films by pulsed ion beam annealing, 9:50233 (BA;NL)
Electron beam processing of semiconductors, 9:50242 (BA;NL)
Flame annealing of ion implanted silicon, 9:50240 (BA;NL)
Impurity distribution profiles and surface disorder after laser induced diffusion, 9:50222 (BA;NL)
Impurity diffusion in silicon annealed by semi-continuous laser, 9:50250 (BA;NL)
Impurity redistribution in ion implanted Si after picosecond Nd laser pulse irradiation, 9:50221 (BA;NL)
Ion beam processes in Si, 9:50184 (R;US)
Ising model simulations of impurity trapping in silicon, 9:50217 (BA;NL)
Isothermal annealing of ion implanted silicon with a graphite radiation source, 9:50237 (BA;NL)
Laser-induced solid phase crystallization in amorphous silicon films, 9:50244 (BA;NL)
Microprobe Raman analysis of picosecond laser annealing of implanted silicon, 9:50218 (BA;NL)
Processing of shallow (Rp<150 /SUP o/ A) implanted layers with electron beams, 9:50238 (BA;NL)
Surface studies of laser annealed semiconductors, 9:50239 (BA;NL)
Transient annealing of ion-implanted silicon using a scanning IR line source, 9:50234 (BA;NL)
Ion Microprobe Analysis
Channeling contrast microscopy: application to large grain polycrystalline silicon, 9:50283 (RA;AU)
Irradiation
Linear zone-melt recrystallized Si films using incoherent light, 9:50154 (BA;NL)
Mobility
Conduction in polycrystalline silicon: generalized thermionic emission-diffusion theory and extended state mobility model, 9:50247 (BA;NL)
Nuclear Magnetic Resonance
Studies of hydrogenated amorphous silicon, 9:49627 (R;US)
Optical Scanners
Beam processing of silicon with a scanning CW Hg lamp, 9:50236 (BA;NL)
Physical Radiation Effects
Aligned, coexisting liquid and solid regions in pulsed and cw laser annealing of Si, 9:50219 (BA;NL)
Interferometric measurements of surface properties during laser annealing, 9:50251 (BA;NL)
Investigation of semiconductor materials proton damage by radiography, 9:50198 (RA;SU;In Russian)
Investigation of laser and electron induced recrystallization of silicon layers by means of channeling techniques, 9:50200 (RA;SU)
Isothermal annealing of ion implanted silicon with a graphite radiation source, 9:50237 (BA;NL)
Laser-induced crystallization of silicon on bulk amorphous substrates: An overview, 9:50226 (BA;NL)
Laser-induced surface defects, 9:50252 (BA;NL)
Picosecond laser-induced surface transformations in solids, 9:50253 (BA;NL)
Pulsed Irradiation
Impurity diffusion in silicon annealed by semi-continuous laser, 9:50250 (BA;NL)
Reaction Kinetics
Laser-induced solid phase crystallization in amorphous silicon films, 9:50244 (BA;NL)
Recrystallization
A comparison of CW laser and electron-beam recrystallization of polysilicon in multilayer structures, 9:50225 (BA;NL)
Beam processing of silicon with a scanning CW Hg lamp, 9:50236 (BA;NL)
Beam shaping for CW laser recrystallization of polysilicon films, 9:50224 (BA;NL)
Characteristics of recrystallised polysilicon on SiO_2 produced by dual electron beam processing, 9:50241 (BA;NL)
Crystallization of amorphous silicon films by pulsed ion beam annealing, 9:50233 (BA;NL)
Electrical characteristics and device applications of zone-melting-recrystallized Si films on SiO_2, 9:50231 (BA;NL)
Electron beam processing of semiconductors, 9:50242 (BA;NL)
Linear zone-melt recrystallized Si films using incoherent light, 9:50154 (BA;NL)
Measurement of fast melting and regrowth velocities in picosecond laser heated silicon, 9:50223 (BA;NL)
Microprobe Raman analysis of picosecond laser annealing of implanted silicon, 9:50218 (BA;NL)
Pulsed electron beam annealing induced deep level defects in virgin silicon, 9:50232 (BA;NL)
The effects of selectively absorbing dielectric layers and beam shaping on recrystallization and FET characteristics in laser recrystallized silicon on amorphous substrates, 9:50227 (BA;NL)
Transient annealing of ion-implanted silicon using a scanning IR line source, 9:50234 (BA;NL)
Stress Analysis
Stress studies in EFG. Quarterly progress report, April 1-June 30, 1984, 9:50187 (R;US)
Surface Area
Impurity distribution profiles and surface disorder after laser induced diffusion, 9:50222 (BA;NL)
Surface Properties
Interferometric measurements of surface properties during laser annealing, 9:50251 (BA;NL)
Picosecond laser-induced surface transformations in solids, 9:50253 (BA;NL)
Thermal Diffusion
Analysis of temperature and stress profiles induced by a CW line scanned electron beam in <100> oriented silicon, 9:50249 (BA;NL)

Thermal Stresses
Analysis of temperature and stress profiles induced by a CW line scanned electron beam in <100> oriented silicon, 9:50249 (BA;NL)
Thermionic Emission
Conduction in polycrystalline silicon: generalized thermionic emission-diffusion theory and extended state mobility model, 9:50247 (BA;NL)
Zone Melting
A comparison of CW laser and electron-beam recrystallization of polysilicon in multilayer structures, 9:50225 (BA;NL)
Amorphous Si, crystallization and melting, 9:50220 (BA;NL)
Electrical characteristics and device applications of zone-melting-recrystallized Si films on SiO_2, 9:50231 (BA;NL)
Impurity distribution profiles and surface disorder after laser induced diffusion, 9:50222 (BA;NL)
Impurity redistribution in ion implanted Si after picosecond Nd laser pulse irradiation, 9:50221 (BA;NL)
Linear zone-melt recrystallized Si films using incoherent light, 9:50154 (BA;NL)
Measurement of fast melting and regrowth velocities in picosecond laser heated silicon, 9:50223 (BA;NL)

SILICON 28 TARGET
Electron Reactions
Analyses of electron and proton scattering to low excitation isoscalar states in ^{20}Ne, ^{24}Mg and ^{28}Si, 9:50856 (R;AU)
Pion Plus Reactions
Excitation of giant resonances in pion inelastic scattering, 9:50847 (J;FR)
Proton Reactions
Analyses of electron and proton scattering to low excitation isoscalar states in ^{20}Ne, ^{24}Mg and ^{28}Si, 9:50856 (R;AU)

SILICON ALLOYS
Physical Radiation Effects
Radiation-induced compositional redistribution and local phase transformation in irradiated alloys, 9:50101 (R;US)

SILICON CARBIDES
Chemical Vapor Deposition
Fabrication of ceramic-ceramic composites by chemical vapor deposition (SiC-$TiSi_2$), 9:50173 (R;US)
Study of the gas phase deposition of silicon carbide and its application for impregnation of reactively bound silicon carbide and for the manufacture of SiC/SiC composites, 9:50164 (R;DE;In German)
Impregnation
Study of the gas phase deposition of silicon carbide and its application for impregnation of reactively bound silicon carbide and for the manufacture of SiC/SiC composites, 9:50164 (R;DE;In German)
Ion Implantation
Reactivity of ion implanted silicon carbide, 9:50160 (R;US)
Mechanical Properties
Study of the gas phase deposition of silicon carbide and its application for impregnation of reactively bound silicon carbide and for the manufacture of SiC/SiC composites, 9:50164 (R;DE;In German)
Reinforced Materials
Study of the gas phase deposition of silicon carbide and its application for impregnation of reactively bound silicon carbide and for the manufacture of SiC/SiC composites, 9:50164 (R;DE;In German)

SILICON CHLORIDES
Chemical Preparation
Laboratory scale studies of $SiHCl_3$ synthesis, 9:50300 (R;TW;CH)

SILICON NITRIDES
Coatings
Process-included topological changes of monocrystalline silicon plates, 9:50205 (R;DE;In German)
Fabrication
Fabrication of SiC whiskers and composites, 9:50174 (R;US)

SILICON OXIDES
See also SILICA
Coatings
Process-included topological changes of monocrystalline silicon plates, 9:50205 (R;DE;In German)

SILICON SOLAR CELLS
Efficiency
Attainment of 10 percent conversion efficiency in amorphous silicon solar cells, 9:49651 (BA;US)
Electric Contacts
Laser-assisted solar cell metallization processing. Quarterly report, March 13-June 12, 1984, 9:49609 (R;US)
Electric Potential
Voltage controlling mechanisms in low resistivity silicon solar cells: a unified approach, 9:49613 (R;US)
Energy Efficiency
High efficiency silicon solar cells, 9:49634 (BA;US)
Fabrication
V-Groove silicon solar cell, 9:49638 (BA;US)
Grain Boundaries
Studies of grain boundaries in small-grained polycrystalline silicon solar cells, 9:49636 (BA;US)
Heat Treatments
Development of high-efficiency solar cells on silicon web. First quarterly progress report, April 20-July 15, 1984, 9:49610 (R;US)
Impurities
Impurities in polycrystalline silicon solar cells, 9:49635 (BA;US)
Mathematical Models
Development of high-efficiency solar cells on silicon web. First quarterly progress report, April 20-July 15, 1984, 9:49610 (R;US)
Meetings
Progress report 22, January-September 1983 and proceedings of the 22nd Project Integration meeting, 9:49607 (R;US)
Performance
Impurities in polycrystalline silicon solar cells, 9:49635 (BA;US)
Reliability
Accelerated degradation of silicon metallization systems, 9:49614 (R;US)
Research Programs
Progress report 22, January-September 1983 and proceedings of the 22nd Project Integration meeting, 9:49607 (R;US)
Twinning
Development of high-efficiency solar cells on silicon web. First quarterly progress report, April 20-July 15, 1984, 9:49610 (R;US)

SILICONES
Photon Transport
Vacuum ultraviolet electronic properties of liquids. Annual progress report, February 1, 1984-January 31, 1985, 9:50927 (R;US)

SILICOSIS
See PNEUMOCONIOSES

SILVER
Electronic Structure
Interface magnetism in metals: Ag/Fe(001), 9:50142 (J;US)
Magnetic Properties
Interface magnetism in metals: Ag/Fe(001), 9:50142 (J;US)

SILVER ALLOYS
Electric Conductivity
Resistivity of alloys, 9:50946 (R;US)
Grain Boundaries
Atomistic studies of grain boundaries with segregated impurities. Final progress report, July 1983-June 30, 1984, 9:50108 (R;US)

SIMS
See ION MICROPROBE ANALYSIS
MASS SPECTROSCOPY

SIMULATORS (REACTOR)
See REACTOR SIMULATORS

SINGLE CRYSTALS
See MONOCRYSTALS

SINTERING
Correlations
Comparison of low-rank coal ash sintering characteristics with pilot plant ash fouling tendencies, 9:49377 (R;US)

SISTER CHROMATID EXCHANGES
Radioinduction
Effects of cellular non-protein sulfhydryl depletion in radiation induced oncogenic transformation and genotoxicity in mouse C_3H 10T1/2 cells, 9:50616 (J;US)
Paraquat and radiation effects on mouse C_3H 10T1/2 cells, 9:50617 (J;US)
SIZEWELL NUCLEAR POWER STATION B
See SIZEWELL-B REACTOR
SIZEWELL-B REACTOR
Sizewell, Suffolk, USA
Meltdown
Assessment of the radiological consequences of releases to groundwater following a core-melt accident at the Sizewell PWR, 9:49848 (R;GB)
SLAGS
Mineralogy
Ash and slag characterization, 9:49431 (RA;US)
Removal
Slag capture and removal during laser cutting, 9:50147 (P;US)
Waste Product Utilization
Solid wastes from coal and shale: projections of waste forms and utilizatiou potential, 9:49384 (R;US)
SLC
See STANFORD LINEAR COLLIDER
SLIGHTLY ENRICHED URANIUM
0 - 5 per cent.
Dissolution
Dissolution of unirradiated UO_2-pellets in nitric acid, 9:49521 (R;DE;In German)
Reactivity
Calculations of K with burn-up for various enrichments for MTR type core, 9:49842 (R;PK)
SLUDGES
Chemical Composition
Organic and inorganic mercury species in the Ft. Lewis solvent refined coal pilot plant water treatment process. Technical report, 9:49361 (R;US)
SLUGS (FUEL)
See FUEL RODS
SLURRIES
See also FUEL SLURRIES
Performance
Improvement of the performance of solar energy or waste heat utilization systems by using phase-change slurry as an enhanced heat-transfer/storage fluid, 9:49710 (BA;US)
Phase Change Materials
Improvement of the performance of solar energy or waste heat utilization systems by using phase-change slurry as an enhanced heat-transfer/storage fluid, 9:49710 (BA;US)
SLURRIES (FUEL)
See FUEL SLURRIES
SLURRY PIPELINES
Computer Calculations
Slurry pipeline cost analysis computer program, 9:49418 (R;GB)
Economic Analysis
Slurry pipeline cost analysis computer program, 9:49418 (R;GB)
Feasibility Studies
Slurry pipeline cost analysis computer program, 9:49418 (R;GB)
SMALL BUSINESSES
Surveys
Problems of small, high-technology firms, 9:49926 (R;US)
SMALL-SCALE HYDROELECTRIC POWER PLANTS
Repair
Tennessee Valley Authority's benefits and cost for rehabilitating the Ocoee No. 2 hydroelectric project, 9:49598 (R;US)
Research Programs
DOE Small-Scale Hydropower Program annual status report 1984, 9:49592 (R;US)
Retrofitting
Tennessee Valley Authority's benefits and cost for rehabilitating the Ocoee No. 2 hydroelectric project, 9:49598 (R;US)
SMELTING
Environmental Effects
Copper smelters and atmospheric visibility in the southwest, seasonal analysis, 9:50534 (J;US)
SMES
See SUPERCONDUCTING MAGNETIC ENERGY STORAGE
SMOKES
Chemical Composition
Mercury species present in smoke from coal fire. Water soluble mercury species in air and precipitation, 9:50530 (R;SE;In Swedish)
SODA ASH
See SODIUM CARBONATES
SODIUM
Absorption
High-temperature removal of alkali vapors in hot-gas cleaning systems, 9:49343 (RA;US)
Absorption Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Activation Analysis
Neutron activation analysis on a series of human gallstones, 9:50272 (RA;AU)
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Emission Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Ion Microprobe Analysis
Application of an alpha particle microbeam to tissue analysis in medicine, 9:50276 (RA;AU)
SODIUM 27
Mass
Masses and level schemes of very neutron-rich nuclei with A approximately 30, 9:50851 (RA;AU)
SODIUM CARBONATES
See also SHORTITE
Chemical Reaction Kinetics
Development of a hot gas cleanup system for integrated coal gasification/molten carbonate fuel cell power plants, 9:49341 (RA;US)
Chemical Reactions
Study of the reaction of SO_2 with $NaHCO_3$ and Na_2CO_3, 9:49403 (J;US)
SODIUM CHLORIDES
Adsorption
Alkali removal from hot combustion gases by adsorption on submicron-size particles, 9:49393 (RA;US)
Diffusion
Interface movement in salt-gradient solar ponds, 9:49711 (BA;US)
Thermodynamic Properties
Thermodynamic properties of aqueous NaC1 from 273 to 823 K with estimates for higher temperatures, 9:50301 (R;US)
SODIUM MINERALS
See MINERALS
SODIUM PHOSPHATES
Solubility
High temperature aqueous solutions and energy considerations - physical chemical studies, 9:50298 (R;US)
SODIUM SULFATES
Solubility
High temperature aqueous solutions and energy considerations - physical chemical studies, 9:50298 (R;US)
SODIUM-WATER REACTIONS
See MOLTEN METAL-WATER REACTIONS
SOILS
Heat Transfer
Effect of soil conditions on solar pond performance, 9:49712 (BA;US)
Mass Transfer
Development of numerical simulation models for vertical solute transport in unsaturated soils and unconsolidated sediments, 9:50554 (R;DE;In German)
Effect of soil conditions on solar pond performance, 9:49712 (BA;US)

Radioactive Waste Processing
Off-gas treatment and characterization for a radioactive in situ vitrification test, 9:49556 (R;US)
Radioactivity
Remedial action at the Acid/Pueblo Canyon site, Los Alamos, New Mexico. Final report, 9:49567 (R;US)
Sampling
Soil sampling quality assurance user's guide, 9:50552 (R;US)
Scintillation Counting
Joint comparative research on gamma-ray emitting radionuclides in samples from the Danube-Black Sea territorial complex, 9:50559 (RA;BG;In Bulgarian)
Thermal Conductivity
Effect of soil conditions on solar pond performance, 9:49712 (BA;US)
Vitrification
Off-gas treatment and characterization for a radioactive in situ vitrification test, 9:49556 (R;US)

SOLAR ABSORBERS
Materials
Carbon particles, 9:50214 (P;US)
Polymers
Polymers in solar energy utilization, 9:49631 (BA;US)

SOLAR ACCESS
Prior to September 1980 this concept was indexed to SOLAR RIGHTS.
Planning
Solar access protection: executive summaries of the 1981-1982 Bonneville Power financial assistance grants to local governments, 9:49601 (R;US)

SOLAR AIR CONDITIONERS
See also SOLAR-ASSISTED HEAT PUMPS
Desiccants
Modeling of solid-side mass transfer in desiccant particle beds, 9:49700 (BA;US)
Installation
Fabrication, testing, installation, and start-up of a 53 kW solar absorption cooling system, 9:49685 (R;US)
Testing
Fabrication, testing, installation, and start-up of a 53 kW solar absorption cooling system, 9:49685 (R;US)

SOLAR ARCHITECTURE
Passive solar homes (Glossary), 9:49702 (B;US)

SOLAR BATTERIES
See SOLAR CELL ARRAYS

SOLAR CELL ARRAYS
Connectors
Safety requirements for wiring systems and connectors for photovoltaic systems. Final report, 9:49608 (R;US)
Design
Getting the current out, 9:49615 (R;US)
Electric Cables
Safety requirements for wiring systems and connectors for photovoltaic systems. Final report, 9:49608 (R;US)
Failures
Design solutions for the solar cell interconnect fatigue fracture problem, 9:49650 (BA;US)
Review of PV module performance at DOE/MIT Lincoln Laboratory test sites during the period 1977-1982, 9:49648 (BA;US)
Installation
Automated installation methods for photovoltaic Arrays II, 9:49624 (R;US)
Safety Standards
Safety requirements for wiring systems and connectors for photovoltaic systems. Final report, 9:49608 (R;US)
Standards
Proposed first edition of the standard for flat-plate photovoltaic modules and panels, UL 1703, 9:49621 (R;US)
Stresses
Empirical testing of structural deflection modeling of large photovoltaic modules, 9:49649 (BA;US)

SOLAR CELL RECEIVERS
See SOLAR RECEIVERS

SOLAR CELLS
See also CASCADE SOLAR CELLS
CONCENTRATOR SOLAR CELLS
GALLIUM ARSENIDE SOLAR CELLS
SILICON SOLAR CELLS
Aging
Technical applications of solar energy. Project photovoltaic systems and project selective coatings. Final Report, Feb. 1982, 9:49620 (R;DE)
Connectors
Design solutions for the solar cell interconnect fatigue fracture problem, 9:49650 (BA;US)
Decomposition
Stability of thin-film Cu2S-based solar cells at Voc under continuous illumination, 9:49639 (BA;US)
Design
Particle size effects on viscosity of silver pastes: a manufacturer's view, 9:49617 (R;US)
Electric Contacts
Metallization problems with concentrator cells, 9:49616 (R;US)
Energy Efficiency
10 percent efficient ITO-CdTe heterojunction solar cell, 9:49647 (BA;US)
Energy Losses
Optimization of a-Si solar cell current collection, 9:49644 (BA;US)
Fabrication
Amorphous materials and recrystallization, 9:50420 (R;US)
Cu/Cu2O cells prepared by hydrogen bombardment, 9:49643 (BA;US)
Disilane versus monosilane: a comparison of the properties of glow-discharge a-Si:H films and solar cells, 9:49646 (BA;US)
Interaction between cast silicon properties and solar cell performance, 9:49632 (BA;US)
Laser assisted deposition, 9:49618 (R;US)
Progress in growth of silicon ribbon by a low angle, high rate process, 9:49633 (BA;US)
Grain Boundaries
Enhanced diffusion of phosphorus at grain boundaries, 9:49637 (BA;US)
Heterojunctions
10 percent efficient ITO-CdTe heterojunction solar cell, 9:49647 (BA;US)
Study of heterojunction solar cells based on n-CdS and several P-type semiconductors, 9:49612 (R;US)
Performance
Interaction between cast silicon properties and solar cell performance, 9:49632 (BA;US)
Polymers
Polymers in solar energy utilization, 9:49631 (BA;US)
Research Programs
Amorphous silicon materials and solar cells: progress and directions, 9:49645 (BA;US)
Temperature Effects
Estimation of magnitude and frequency of occurrence of high cell temperatures in reverse bias, 9:49641 (BA;US)

SOLAR COLLECTORS
See also FLAT PLATE COLLECTORS
SOLAR PONDS
Aging
Technical applications of solar energy. Project photovoltaic systems and project selective coatings. Final Report, Feb. 1982, 9:49620 (R;DE)
Economic Analysis
Characterization of representative air and liquid-type collectors for solar economic analysis in residences, 9:49698 (BA;US)
Materials Testing
Solar tests of aperture plate materials for solar thermal dish collectors, 9:49706 (R;US)
Performance
Component report performance of solar collector arrays and collector controllers in the National Solar Data Network, 9:49693 (R;US)
Testing
Sandia concentrator array testing experiences, 9:49717 (BA;US)

SOLAR CONCENTRATORS
See also LUMINESCENT CONCENTRATORS
SOLAR REFLECTORS
Performance Testing
JPL tests of a LaJet concentrator facet, 9:49705 (R;US)

Reviews
Photovoltaic concentrator progress, 9:49716 (BA;US)
Wind Loads
Wind loading on solar concentrators: some general considerations, 9:49663 (R;US)
SOLAR COOLING SYSTEMS
See also SOLAR AIR CONDITIONERS
Irreversible Processes
Cycle and system irreversibilities of solar powered absorption cooling, 9:49699 (BA;US)
Performance
Component report performance of solar collector arrays and collector controllers in the National Solar Data Network, 9:49693 (R;US)
Systems Analysis
Cycle and system irreversibilities of solar powered absorption cooling, 9:49699 (BA;US)
SOLAR CYCLE
A comparative look at sunspot cycles, 9:50697 (R;US)
SOLAR DISTRICT HEATING
Computerized Simulation
Computational simulation of solar heating systems with seasonal heat storage, 9:49719 (R;FI)
Heat Storage
Computational simulation of solar heating systems with seasonal heat storage, 9:49719 (R;FI)
SOLAR DRYERS
Optimization
Drying grapes with solar energy, 9:49682 (R;DE;In German)
Performance
Drying grapes with solar energy, 9:49682 (R;DE;In German)
SOLAR DRYING
Solar Air Heaters
Drying grapes with solar energy, 9:49682 (R;DE;In German)
SOLAR ENERGY
Appropriate Technology
Solar collection, 9:49696 (R;US)
Grants
Solar collection, 9:49696 (R;US)
Market
Assuring consumer information and protection in the solar market: need, status, strategy, 9:49603 (R;US)
Surveys
Electric utility solar energy activities: 1983 survey, 9:49604 (R;US)
SOLAR FLARES
Gamma Spectra
Nuclear processes in the jets of SS433, 9:50693 (R;US)
Hard X Radiation
Acceleration and confinement of energetic particles in the 7 June 1980 solar flare, 9:50687 (R;AU)
Hard X-ray and microwave morphology, 9:50692 (R;US)
High resolution hard X-ray spectra of solar and cosmic sources, 9:50684 (R;US)
Timing analysis of hard X-ray emission and 22 GHz flux and polarization in a solar burst, 9:50688 (R;BR)
Joule Heating
Acceleration of runaway electrons and Joule heating in solar flares, 9:50682 (R;US)
Microwave Radiation
Acceleration and confinement of energetic particles in the 7 June 1980 solar flare, 9:50687 (R;AU)
Hard X-ray and microwave morphology, 9:50692 (R;US)
Timing analysis of hard X-ray emission and 22 GHz flux and polarization in a solar burst, 9:50688 (R;BR)
Neutrino Reactions
The contribution of cosmogenic radioisotopes to solar neutrino flux measurements, 9:50709 (J;US)
Runaway Electrons
Acceleration of runaway electrons and Joule heating in solar flares, 9:50682 (R;US)
Solar Electrons
Energetic electrons in impulsive solar flares, 9:50696 (R;US)
SOLAR HEAT ENGINES
Parabolic Dish Collectors
Nomographic methodology for use in performance trade-off studies of parabolic dish solar power modules, 9:49664 (R;US)
Surveys
Survey of manufacturers of high-performance heat engines adaptable to solar applications, 9:49665 (R;US)
Systems Analysis
Nomographic methodology for use in performance trade-off studies of parabolic dish solar power modules, 9:49664 (R;US)
SOLAR HEATING SYSTEMS
See also PASSIVE SOLAR HEATING SYSTEMS
SOLAR-ASSISTED HEAT PUMPS
Performance
Actual versus design performance of solar systems in the National Solar Data Network, 9:49694 (R;US)
Component report performance of solar collector arrays and collector controllers in the National Solar Data Network, 9:49693 (R;US)
Solar energy system case study: Telex Communications, Blue Earth, Minnesota, 9:49691 (R;US)
SOLAR INDUSTRY
Consumer Protection
Assuring consumer information and protection in the solar market: need, status, strategy, 9:49603 (R;US)
Surveys
Solar energy industry survey, 9:49684 (R;US)
SOLAR KILNS
Design
Solar heated rotary kiln, 9:49697 (P;US)
SOLAR NEUTRINOS
Prior to July, 1975 information was indexed to NEUTRINOS.
Neutrino Detection
Feasibility of a $^{81}Br(\nu,e^{-})\,^{81}Kr$ solar neutrino experiment, 9:50706 (J;US)
SOLAR ONE POWER PLANT
See BARSTOW SOLAR PILOT PLANT
SOLAR PONDS
Heat Extraction
Salt-gradient solar pond development. Final report, September 1, 1982-February 29, 1984, 9:49707 (R;US)
Interfaces
Interface movement in salt-gradient solar ponds, 9:49711 (BA;US)
Mathematical Models
Effect of soil conditions on solar pond performance, 9:49712 (BA;US)
Performance
Effect of soil conditions on solar pond performance, 9:49712 (BA;US)
Salinity Gradients
Interface movement in salt-gradient solar ponds, 9:49711 (BA;US)
Salt-gradient solar pond development. Final report, September 1, 1982-February 29, 1984, 9:49707 (R;US)
Temperature Distribution
Interface movement in salt-gradient solar ponds, 9:49711 (BA;US)
SOLAR POWER PLANTS
See also OCEAN THERMAL POWER PLANTS
PHOTOVOLTAIC POWER PLANTS
SOLAR THERMAL POWER PLANTS
Development and evaluation of the Texas Instruments Solar Energy System, 9:49677 (BA;US)
SOLAR RADIATION
Measuring Instruments
Passive exposure of Earth radiation budget experiment components (A0147), 9:50681 (R;US)
SOLAR RADIO BURSTS
Acceleration and confinement of energetic particles in the 7 June 1980 solar flare, 9:50687 (R;AU)
SOLAR RECEIVERS
See also CENTRAL RECEIVERS
Design
Experimental and theoretical study of a solar thermochemical receiver module, 9:49666 (R;US)
Performance
Analytical optical power concentration calculations for reflection for spherical mirrors, 9:49713 (BA;US)

Thermochemical Processes
Experimental and theoretical study of a solar thermochemical receiver module, 9:49666 (R;US)

SOLAR REFLECTORS
See also PARABOLIC REFLECTORS
Computerized Simulation
A computer model for stress analysis of spherically curved solar panels, 9:49708 (BA;US)
Cost Benefit Analysis
Technical and cost potential for lightweight, stretched-membrane heliostat technology, 9:49709 (BA;US)
Design
Technical and cost potential for lightweight, stretched-membrane heliostat technology, 9:49709 (BA;US)
Stress Analysis
A computer model for stress analysis of spherically curved solar panels, 9:49708 (BA;US)

SOLAR SEA POWER PLANTS
See OCEAN THERMAL POWER PLANTS

SOLAR SPACE HEATING
Chemical Heat Pumps
Dynamic model for thermochemical heat storage with application to solar heating, 9:49720 (R;FI)
Computerized Simulation
Dynamic model for thermochemical heat storage with application to solar heating, 9:49720 (R;FI)

SOLAR THERMAL POWER PLANTS
See also TOWER FOCUS POWER PLANTS
Molten Salts
Operation and control of a solar molten salt steam generating system, 9:49675 (BA;US)
Operation
Operation and control of a solar molten salt steam generating system, 9:49675 (BA;US)

SOLAR THERMAL RECEIVERS
See SOLAR RECEIVERS

SOLAR WATER HEATERS
Energy on an independent farm. Final performance report, 9:49734 (R;US)
Performance
Actual versus design performance of solar systems in the National Solar Data Network, 9:49694 (R;US)
Component report performance of solar collector arrays and collector controllers in the National Solar Data Network, 9:49693 (R;US)
Living Systems. Monthly performance report, 9:49695 (R;US)

SOLAR WIND
Helium Ions
Observations of He+ ions in the solar wind, 9:50683 (R;SE)
Hydrodynamics
Application of a global solar wind/planetary obstacle interaction computational model: Earth, Venus, Mars, Jupiter, and Saturn studies, 9:50685 (R;US)
Magnetohydrodynamics
Coalescence of two pressure waves associated with stream interactions, 9:50689 (R;US)

SOLAR-ASSISTED HEAT PUMPS
Computerized Simulation
Testing and computer simulation of an air based, solar assisted heat pump system, 9:49701 (BA;US)
Performance
Testing and computer simulation of an air based, solar assisted heat pump system, 9:49701 (BA;US)

SOLID ELECTROLYTES
Polymers
Polyelectrolytes as interfaces for retarding back-reaction in photoinduced electron transfer, 9:50335 (R;US)

SOLID FUELS
Combustion
Effects of solid fuel fired plants for district heating. Air quality studies in two towns, 9:49406 (R;SE;In Swedish)

SOLID SOLUTIONS
Saturation
Phase equilibria in aluminium-lithium-magnesium alloys at 200°C, 300°C and 400°C and their hardening in a casting state, 9:50134 (R;DE;In German)

SOLID WASTES
See also MINERAL WASTES
TAILINGS
Sorting
Zigzag configurations and air classifier performance, 9:50430 (J;US)
Waste Management
Assessment of research and development for the management of fossil energy-related solid wastes, 9:49399 (R;US)

SOLIDS
Mathematical Models
Three-dimensional model for a porous elastic anisotropic solid with inclusions, taking into account dissipation, heat flux, radiation and thermal stress, 9:51061 (R;US)

SOLID-STATE PLASMA
Absorption Spectra
Optically induced intervalence-band transitions in germanium by the absorption of 1.06 μm picosecond pulses, 9:50943 (R;US)

SOLITONS
Solitons in solid state physics, 9:50973 (R;AT)

SOLVENT-REFINED COAL
Denitrification
Alternative modes of processing SRC in an expanded-bed LC-finer to produce low-nitrogen distillates, 9:49372 (J;US)
Purification
Alternative modes of processing SRC in an expanded-bed LC-finer to produce low-nitrogen distillates, 9:49372 (J;US)

SOLVENT-REFINED COAL PROCESS
See SRC PROCESS

SOLVENT-REFINING COAL PLANTS
See COAL PREPARATION PLANTS
SRC PROCESS

SOLVENTS
See also ORGANIC SOLVENTS
Hydrogen Transfer
The importance of hydrogen donors in the solvent conversion of eastern shale, 9:49499 (BA;US)
Performance
The importance of hydrogen donors in the solvent conversion of eastern shale, 9:49499 (BA;US)

SOUND
See SOUND WAVES

SOUND WAVES
Wave Propagation
Propagation of sound at continuous structural phase transitions, 9:50941 (R;US)

SOUTH AFRICA
Geology
Sedimentology 82: Abstracts. Sedimentology applied to exploration, mining, engineering and environmental studies, 9:50659 (R;ZA)
Nuclear Power Plants
Laboratory measurements of subsynchronous resonance, 9:49762 (R;ZA)

SPACE FLIGHT
Radiation Hazards
Approaches to radiation guidelines for space travel, 9:50607 (R;US)

SPACE POWER REACTORS
Fuel Elements
710 reactor program. Progress report No. 17, 9:49784 (R;US)
Gas Turbines
710 reactor program. Progress report No. 17, 9:49784 (R;US)
Reactor Control Systems
Instrumentation and Controls evaluation for space nuclear power systems, 9:49817 (R;US)
Reactor Cores
710 reactor program. Progress report No. 17, 9:49784 (R;US)
Reactor Instrumentation
Instrumentation and Controls evaluation for space nuclear power systems, 9:49817 (R;US)
Reactor Kinetics
710 reactor program. Progress report No. 17, 9:49784 (R;US)
Reactor Materials
710 reactor program. Progress report No. 17, 9:49784 (R;US)

SPACE VEHICLES
X-Ray Fluorescence Analyzers
Proposal for electron beam induced remote sensing x-ray fluorescence investigation of minor bodies in the solar system. Experiment IND-X, 9:50673 (R;HU)
SPACE-TIME
Quantum Mechanics
Quantum relativity theory, 9:50963 (R;HU)
Square-Well Potential
4- atomism. One-dimensional potential dimple, 9:50962 (RA;BG;In Bulgarian)
SPARK IGNITION ENGINES
Fuel Injection Systems
Prospects of the otto-engine with carburetor, fuel injection and stratified charge, 9:50073 (RA;DD;In German)
Performance Testing
A single cylinder engine study of lean supercharged operation for spark ignition engines, 9:50083 (BA;US)
Improved spark ignition engine efficiency through lean turbocharged operation, 9:50084 (BA;US)
Superchargers
A single cylinder engine study of lean supercharged operation for spark ignition engines, 9:50083 (BA;US)
Improved spark ignition engine efficiency through lean turbocharged operation, 9:50084 (BA;US)
Systems Analysis
Prospects of the otto-engine with carburetor, fuel injection and stratified charge, 9:50073 (RA;DD;In German)
SPECIAL RELATIVITY THEORY
See RELATIVITY THEORY
SPECTROCHEMISTRY
See EMISSION SPECTROSCOPY
SPECTROMETERS
See also HEAVY ION SPECTROMETERS
MASS SPECTROMETERS
MULTIPARTICLE SPECTROMETERS
X-RAY SPECTROMETERS
Digitizers
Description and repair procedure for optical digitizers PAC-4, 9:50500 (R;PK)
SPECTROSCOPY
See also EMISSION SPECTROSCOPY
GAMMA SPECTROSCOPY
MASS SPECTROSCOPY
PHOTOACOUSTIC SPECTROSCOPY
X-RAY SPECTROSCOPY
Fluctuation experiments on atomic and molecular systems using the one-atom detector, 9:50339 (J;NL)
Fiber Optics
Development of particle-sizing for high concentrated colloidal dispersions based on photon correlations spectroscopy, 9:50296 (R;DE;In German)
SPENT FUEL ELEMENTS
Purex Process
Decontamination of carbonate containing process streams in a reprocessing plant by chromatography, 9:49519 (R;DE;In German)
SPENT FUELS
Dry Storage
Dry storage of LWR spent fuel in the US: a status report, 9:49523 (R;US)
SPENT SHALES
Environmental Impacts
The reactivity of pyrite in raw eastern oil shale and its transformation during processing, 9:49506 (BA;US)
Waste Product Utilization
Solid wastes from coal and shale: projections of waste forms and utilization potential, 9:49384 (R;US)
SPINORS
Algebra
Algebra of two-component spinors. A revision, 9:50981 (R;AT;In German)
SPOIL BANKS
Land Reclamation
What restoration ecology can tell us about mycorrhiza, 9:50549 (R;US)
Revegetation
What restoration ecology can tell us about mycorrhiza, 9:50549 (R;US)
SQUARE-WELL POTENTIAL
Energy Levels
4- atomism. One-dimensional potential dimple, 9:50962 (RA;BG;In Bulgarian)
SQUID DEVICES
Superconducting Quantum Interference Devices
Uses
dc SQUID as a tuned radiofrequency amplifier, 9:50373 (R;US)
SRC PROCESS
Bench-Scale Experiments
Coal liquefaction and deashing studies--2. Solvent refined coal process, 9:49375 (J;US)
Control Systems
Design baseline: 6000 tpd SRC-I Demonstration Plant. Volume 2 (revised), 9:49349 (R;US)
Demonstration Plants
Calciner unit SRC-I Coal Refinery, Newman, Kentucky: design baseline. Revision 1, 9:49348 (R;US)
Design baseline: 6000 tpd SRC-1 Demonstration Plant. Volume 4 (revised), 9:49350 (R;US)
Design baseline: 6000 tpd SRC-1 Demonstration Plant. Volume 5 (revised), 9:49351 (R;US)
Design baseline: 6000 tpd SRC-I Demonstration Plant. Volume 2 (revised), 9:49349 (R;US)
SRC-1: coal liquefaction demonstration plant. Project Baseline assessment report supplement, 9:49347 (R;US)
Design
Calciner unit SRC-I Coal Refinery, Newman, Kentucky: design baseline. Revision 1, 9:49348 (R;US)
Design baseline: 6000 tpd SRC-1 Demonstration Plant. Volume 4 (revised), 9:49350 (R;US)
SRC-1: coal liquefaction demonstration plant. Project Baseline assessment report supplement, 9:49347 (R;US)
Equipment
Design baseline: 6000 tpd SRC-1 Demonstration Plant. Volume 4 (revised), 9:49350 (R;US)
Design baseline: 6000 tpd SRC-1 Demonstration Plant. Volume 5 (revised), 9:49351 (R;US)
Flowsheets
Design baseline: 6000 tpd SRC-I Demonstration Plant. Volume 2 (revised), 9:49349 (R;US)
Parametric Analysis
Short residence time coal liquefaction. Topical report, May 1978-July 1982, 9:49354 (R;US)
Risk Assessment
SRC-1: coal liquefaction demonstration plant. Project Baseline assessment report supplement, 9:49347 (R;US)
Waste Heat Utilization
Calciner unit SRC-I Coal Refinery, Newman, Kentucky: design baseline. Revision 1, 9:49348 (R;US)
Yields
Impact of hydrogen partial pressure on coal liquefaction. Final technical report, 9:49346 (R;US)
SRC-II PROCESS
Waste Water
Organic and inorganic mercury species in the Ft. Lewis solvent refined coal pilot plant water treatment process. Technical report, 9:49361 (R;US)
Water Pollution Control
Organic and inorganic mercury species in the Ft. Lewis solvent refined coal pilot plant water treatment process. Technical report, 9:49361 (R;US)
SRRC-UTR-100 REACTOR
Reactor Operation
Scottish Universities Research and Reactor Centre, East Kilbride. Report on session 1982-1983, 9:49840 (R;GB)
STAINLESS STEEL-304
Creep
SANS and TEM studies of carbide precipitation and creep damage in type 304 stainless steel, 9:50103 (R;US)
STAINLESS STEEL-308
Microstructure
Microstructure of rapidly quenched type 308 stainless steel weld filler metal and its implications on rapid solidification processes, 9:50104 (R;US)

STAINLESS STEEL-316
Swelling
Swelling and swelling resistance possibilities of austenitic stainless steels in fusion reactors, 9:50095 (R;US)
STAINLESS STEELS
See also STAINLESS STEEL-304
STAINLESS STEEL-308
STAINLESS STEEL-316
Laser Welding
Microstructure of rapidly quenched type 308 stainless steel weld filler metal and its implications on rapid solidification processes, 9:50104 (R;US)
Physical Radiation Effects
Application of extraction replicas and analytical electron microscopy to precipitate phase studies, 9:50100 (R;US)
STANDING CROP
See BIOMASS
STANFORD 20-GEV LINAC
Klystrons
Multimode harmonic power measurement of 40 MW pulsed S-band klystrons, 9:50464 (R;US)
STANFORD LINEAR COLLIDER
Beam Monitoring
Using television cameras to measure emittance, 9:50453 (R;US)
STARFIRE TOKAMAK
Research Programs
Fusion reactor studies at Argonne National Laboratory. Present status of fusion researches in USA, (2), 9:51043 (J;JP;In Japanese)
STATE BUILDINGS
See PUBLIC BUILDINGS
STEADY FLOW
Flow Models
Steady flow model user's guide, 9:49908 (R;US)
STEAM GENERATORS
Cleaning
Evaluation of on-line chelant addition dilute chemical cleaning. Final report, 9:49771 (R;US)
Design
Molten salt steam generator subsystem research experiment: executive summary. Phase 1, final report, 9:49672 (R;US)
Molten salt steam generator subsystem research experiment: executive summary. Phase I. Specification and preliminary design. Final report, 9:49673 (R;US)
Heat Transfer
MINET simulation of a helical coil sodium/water steam generator, including structural effects, 9:49892 (R;US)
MINET validation study using steam generator transient data, 9:49893 (R;US)
Hydraulics
MINET simulation of a helical coil sodium/water steam generator, including structural effects, 9:49892 (R;US)
MINET validation study using steam generator transient data, 9:49893 (R;US)
Molten Salts
Molten salt steam generator subsystem research experiment: executive summary. Phase 1, final report, 9:49672 (R;US)
Molten salt steam generator subsystem research experiment: executive summary. Phase I. Specification and preliminary design. Final report, 9:49673 (R;US)
Test Facilities
Operation of the EPRI Nondestructive Evaluation Center. 1983 annual report, 9:49933 (R;US)
Transients
MINET simulation of a helical coil sodium/water steam generator, including structural effects, 9:49892 (R;US)
MINET validation study using steam generator transient data, 9:49893 (R;US)
Turbines
Large unbalance vibration analysis of steam turbine generators. Final report, 9:49746 (R;US)
Water Chemistry
High temperature aqueous solutions and energy considerations - physical chemical studies, 9:50298 (R;US)
STEAM TURBINES
Control
Analysis of selected operating modes in WWER 440 nuclear power plants, 9:49823 (RA;CS;In Czech)
Mechanical Vibrations
Large unbalance vibration analysis of steam turbine generators. Final report, 9:49746 (R;US)
Test Facilities
Operation of the EPRI Nondestructive Evaluation Center. 1983 annual report, 9:49933 (R;US)
STEELS
See also AUSTENITIC STEELS
CARBON STEELS
NICKEL STEELS
STAINLESS STEELS
Crack Propagation
Effect of cyclic thermal shock loading on crack growth behavior, 9:50130 (RA;DE;In German)
Energy transformation during dynamic crack initiation and arrest, 9:50121 (RA;DE;In German)
Cracks
Solidification and segregations in heavy ingots, 9:50411 (RA;DE;In German)
Electroslag Welding
Advanced Research and Technology Development Fossil Energy Materials Program. Quarterly progress report ending June 30, 1984, 9:50094 (R;US)
Fracture Properties
Application and evaluation of post-yield fracture mechanics concepts for cracked vessels, 9:49809 (RA;DE;In German)
Influence of loading rate on the fracture toughness vs. temperature curve, 9:50120 (RA;DE;In German)
Nondestructive Testing
Solidification and segregations in heavy ingots, 9:50411 (RA;DE;In German)
Quality Assurance
Solidification and segregations in heavy ingots, 9:50411 (RA;DE;In German)
Thermal Cycling
Effect of cyclic thermal shock loading on crack growth behavior, 9:50130 (RA;DE;In German)
Transmission Electron Microscopy
Transmission electron microscopy of inorganic materials, 9:50092 (R;US)
STIMULATED EMISSION DEVICES
See LASERS
STOKERS
Modifications
Stoker test evaluations using clean pellet fuel, 9:49433 (R;US)
STORAGE BATTERIES
See ELECTRIC BATTERIES
STORAGE BATTERIES (LEAD-ACID)
See LEAD-ACID BATTERIES
STORAGE DEVICES (DATA)
See MEMORY DEVICES
STORAGE RINGS
See also ACO
SUPERCONDUCTING SUPER COLLIDER
Beam Dynamics
Storage ring physics issues for GSI program, 9:50461 (R;DE)
Instability
Suppression of microwave instabilities, 9:50474 (R;DE)
Microwave Radiation
Suppression of microwave instabilities, 9:50474 (R;DE)
Polarized Beams
Complete snake and rotator schemes for spin polarization in proton rings and large electron rings, 9:50473 (R;DE)
Polarized Targets
Design of a tensor polarized deuterium target polarized by spin-exchange with optically pumped NA, 9:50459 (R;US)
STORES
See COMMERCIAL BUILDINGS
STOVER
See AGRICULTURAL WASTES
STRATEGIC PETROLEUM RESERVE
Capacity
Statement of Deputy Assistant Secretary for the Strategic Petroleum Reserve before the Subcommittee on Oversight and Investigations of the Committee on Energy and Commerce, US House of Representatives, 9:49473 (R;US)

Government Policies
Energy emergency preparedness. Hearings before the Subcommittee on Fossil and Synthetic Fuels of the Committee on Energy and Commerce, House of Representatives, Ninety-Eighth Congress, Second Session, February 1, 2, and 21, 1984, 9:49470 (B;US)
Planning
Statement of Deputy Assistant Secretary for the Strategic Petroleum Reserve before the Subcommittee on Oversight and Investigations of the Committee on Energy and Commerce, US House of Representatives, 9:49473 (R;US)

STREAMER SPARK CHAMBERS
Holography
Application of holography in trace detectors of high resolution, 9:50478 (RA;BG;In Bulgarian)

STRENGTH (FRACTURE)
See FRACTURE PROPERTIES

STRESS ANALYSIS
Computer Codes
Using PAFEC as a preprocessor for MSC/NASTRAN, 9:51023 (R;US)

STRESSES
Mechanics.
See also THERMAL STRESSES
Distribution
Internal stresses, 9:50255 (BA;FR)

STRIPED BASS
Population Dynamics
Striped bass, temperature, and eutrophication: a speculative hypothesis for environmental risk, 9:50563 (R;US)

STRONG INTERACTIONS
Coupling Constants
Experimental test of the flavor independence of the quark-gluon coupling constant, 9:50765 (R;DE)

STRONTIUM
Absorption Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Activation Analysis
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Emission Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)

STRONTIUM 90
Uptake
Strontium-90 in the US diet, 1982, 9:50557 (R;US)

STRUCTURAL CHEMICAL ANALYSIS
Meetings
Third Australian conference on nuclear techniques of analysis, 9:50288 (R;AU)

STRUCTURAL MATERIALS
See BUILDING MATERIALS

STRUCTURES (BUILDINGS)
See BUILDINGS

STYRENE POLYMERS
See POLYSTYRENE

SUBBITUMINOUS COAL
Infrared Spectra
Novel analytical approaches to the study of coal beneficiation. Quarterly report, 9:49382 (R;US)
Oxidation
Novel analytical approaches to the study of coal beneficiation. Quarterly report, 9:49382 (R;US)

SUBCRITICAL FLOW
See LAMINAR FLOW

SUBSIDENCE (GROUND)
See GROUND SUBSIDENCE

SULFATES
See also SODIUM SULFATES
ZINC SULFATES
Deposition
Recent field studies of dry deposition to surfaces in plant canopies, 9:50522 (R;US)
Environmental Transport
Regional air quality model assessment and evaluation. Final report, 9:50528 (R;US)
Potentiometry
Kitchensink titrations, 9:50303 (R;US)

SULFHYDRYL COMPOUNDS
See THIOLS

SULFIDES
See also HYDROGEN SULFIDES
MOLYBDENUM SULFIDES
TANTALUM SULFIDES
Diffusion
The electrochemical behavior of sulfide ions in molten cryolite, 9:50333 (J;US)
Electrochemistry
The electrochemical behavior of sulfide ions in molten cryolite, 9:50333 (J;US)
Oxidation
The electrochemical behavior of sulfide ions in molten cryolite, 9:50333 (J;US)

SULFUR
Proton Microprobe Analysis
Elemental microanalysis of individual blood cells, 9:50277 (RA;AU)
Retention
Stoker test evaluations using clean pellet fuel, 9:49433 (R;US)

SULFUR 32 REACTIONS
Fusion Reactions
Measurement of the g-factors of high-spin states in ^{158}Er, 9:50884 (RA;AU)

SULFUR 34 TARGET
Alpha Reactions
Proton induced reactions on ^{37}Cl and their relevance to nucleosynthesis, 9:50853 (RA;AU)

SULFUR 39
Mass
Studies of very neutron-rich light nuclei using a gas target, 9:50860 (RA;AU)

SULFUR COMPOUNDS
See also CARBON OXYSULFIDE
SULFATES
SULFIDES
SULFUR OXIDES
Chemical Reaction Kinetics
Theoretical study of the reaction of AlF^-_b and $AlCl^-_4$ with oxide and sulfide ions, 9:50314 (J;US)
Diffusion
The electrochemical behavior of sulfide ions in molten cryolite, 9:50333 (J;US)
Electrochemistry
The electrochemical behavior of sulfide ions in molten cryolite, 9:50333 (J;US)
Oxidation
The electrochemical behavior of sulfide ions in molten cryolite, 9:50333 (J;US)

SULFUR DIOXIDE
Adsorption
Analytical model for freeboard and in-bed limestone sulfation in fluidized-bed coal combustors, 9:49434 (J;GB)
Development of process for combined NO/sub x//SO/sub x/ control. Technical progress report, September 1984, 9:49400 (R;US)
Biological Effects
Effects of sulfur dioxide on expansion of lesions caused by Corynebacterium nebraskense in maize and by Xanthomonas phaseoli var. sojensis in soybean, 9:50649 (J;US)
Chemical Reactions
Study of the reaction of SO_2 with $NaHCO_3$ and Na_2CO_3, 9:49403 (J;US)
Monitoring
Health and environmental monitoring at the University of Minnesota-Duluth coal gasification facility. Draft, 9:49404 (R;US)
Quantitative Chemical Analysis
Method of preparing $(CH_3)_3SiNSO$ and byproducts thereof, 9:50292 (P;US)
Removal
Results of the first two years of commercial operation of an organic-acid-enhanced FGD (flue gas desulfurization) system. Final report April 1982-April 1984, 9:50438 (R;US)

Standards
National air quality and emission trends report, 1982, 9:50531 (R;US)
SULFUR HYDRIDES
See HYDROGEN SULFIDES
SULFUR OXIDES
See also SULFUR DIOXIDE
Air Pollution Control
Copper smelters and atmospheric visibility in the southwest, seasonal analysis, 9:50534 (J;US)
SO/sub x//NO/sub x/ control, 9:49752 (RA;US)
Thermochemical Processes
Experimental and theoretical study of a solar thermochemical receiver module, 9:49666 (R;US)
SULFUR SULFIDES
See SULFUR
SUN
Binary Stars
Evidence for a solar companion star, 9:50675 (R;US)
SUPERCONDUCTING CAVITY RESONATORS
Performance
Status of rf superconductivity at Argonne National Laboratory, 9:50458 (R;US)
SUPERCONDUCTING MAGNETIC ENERGY STORAGE
Testing
Tests of the 30 MJ superconducting magnetic energy storage unit, 9:49903 (J;FR)
SUPERCONDUCTING MAGNETS
D-T axicell magnet system for MFTF-α+T, 9:51021 (R;US)
Computer-Aided Design
Analytical studies of advanced high-field designs: 20-Tesla large bore superconducting magnets, 9:51042 (J;FR)
Computerized Control Systems
Automation of a cryogenic facility by commercial process control computer, 9:50472 (BA;US)
Cooling
Control of the Tevatron Satellite Refrigeration system, 9:50470 (BA;US)
Design
Experience highlights from the design and manufacture of US LCT coils, 9:51028 (R;US)
Electrical Insulation
Insulation systems engineering, 9:51039 (J;FR)
Failures
Failure of a large cryogenic MHD magnet, 9:51040 (J;FR)
Magnet failure workshop, 9:51041 (J;FR)
Helium Dilution Refrigerators
Commissioning of the Tevatron Satellite Refrigeration system, 9:50471 (BA;US)
Fermilab central helium liquefier operations, 9:50467 (BA;US)
Manufacturing
Experience highlights from the design and manufacture of US LCT coils, 9:51028 (R;US)
Refrigerators
Control of the Tevatron Satellite Refrigeration system, 9:50470 (BA;US)
Test Facilities
Automation of a cryogenic facility by commercial process control computer, 9:50472 (BA;US)
SUPERCONDUCTING QUANTUM INTERFERENCE DEVI
See SQUID DEVICES
SUPERCONDUCTING SUPER COLLIDER
Beam Dynamics
Phase displacement accele ation in the SSC, 9:50454 (R;US)
Beam Luminosity
SSC parameters: what physics demands, 9:50445 (R;US)
SUPERCONDUCTING WIRES
Chemical Composition
Critical current density of bronze-processed multifilamentary Nb_3Sn wires with magnesium addition to the matrix, 9:50141 (J;US)
Critical Current
Critical current density of bronze-processed multifilamentary Nb_3Sn wires with magnesium addition to the matrix, 9:50141 (J;US)
Effect of Ta additions upon in situ prepared Nb_3 Sn-Cu superconducting wire, 9:50386 (J;US)
Critical Field
Effect of Ta additions upon in situ prepared Nb_3 Sn-Cu superconducting wire, 9:50386 (J;US)
Current Density
Critical current density of bronze-processed multifilamentary Nb_3Sn wires with magnesium addition to the matrix, 9:50141 (J;US)
Heat Treatments
Critical current density of bronze-processed multifilamentary Nb_3Sn wires with magnesium addition to the matrix, 9:50141 (J;US)
Microstructure
Critical current density of bronze-processed multifilamentary Nb_3Sn wires with magnesium addition to the matrix, 9:50141 (J;US)
SUPERCONDUCTORS
See also TYPE-II SUPERCONDUCTORS
AC Losses
Subcable test facility, 9:51030 (R;US)
Epitaxy
Superconducting electronic film structures. Annual report 1 January-31 December 1983, 9:50360 (R;US)
Stability
Computer simulation of multiple stability regions in an internally cooled superconducting conductor and of helium replenishment in a bath-cooled conductor, 9:51031 (R;US)
Subcable test facility, 9:51030 (R;US)
Synthesis
Thin film synthesis of superconducting chemical compounds. Final report 1 January 1981-30 December 1983, 9:50182 (R;US)
Test Facilities
Subcable test facility, 9:51030 (R;US)
SUPERGRAVITY
Gravitational field strength and generalized Komar-integral, 9:50976 (R;AT)
Bound State
Bound state Regge trajectories in N=8 supergravity, 9:50814 (BA;US)
Geometry
Geometry of supergravitation, 9:50957 (RA;BG;In Bulgarian)
Grand Unified Theory
Supersymmetry and supergravity, 9:50799 (J;NL)
Particle Interactions
Bound state Regge trajectories in N=8 supergravity, 9:50814 (BA;US)
Perturbation Theory
One-loop infinities in dimensionally reduced supergravities, 9:50965 (R;HU)
SUPERLATTICES
Holes
Quantum size effects in GaAs/GaAs/sub x/P_1/sub -x/ strained-layer superlattices, 9:50206 (J;US)
Photoluminescence
Quantum size effects in GaAs/GaAs/sub x/P_1/sub -x/ strained-layer superlattices, 9:50206 (J;US)
Valence
Quantum size effects in GaAs/GaAs/sub x/P_1/sub -x/ strained-layer superlattices, 9:50206 (J;US)
SUPERNOVA REMNANTS
See also CRAB NEBULA
Cosmic Gamma Bursts
N49: the site of a gamma-ray burst. Preliminary results from X-ray observations, 9:50713 (BA;NL)
Radiation Flux
N49: the site of a gamma-ray burst. Preliminary results from X-ray observations, 9:50713 (BA;NL)
SUPERSYMMETRY
Postulated Particles
Supersymmetry and supergravity, 9:50799 (J;NL)
SUPPLY DISRUPTION
Emergency Plans
DOE (U.S. Department of Energy) proposes emergency fuel savings plan, 9:49948 (J;US)

SURFACE AIR
Radionuclide Migration
Uranium content in surface air in Vienna during the years 1963/64 and 1974 - 1978, 9:50541 (R;AT;In German)
SURFACE MINING
Government Policies
Analysis of proposed changes to federal surface mining and coal leasing policy, 9:49442 (R;US)
Land Reclamation
Physical and chemical problems with reclamation of conifers, 9:49412 (R;US)
SURFACE MINING ACTS
Amendments
Analysis of proposed changes to federal surface mining and coal leasing policy, 9:49442 (R;US)
SURFACE WATERS
See also SEAS
Natural Radioactivity
Gamma-spectrometrical measurements in-situ of natural waters in Bulgaria, 9:50578 (RA;BG;In Bulgarian)
Scintillation Counting
Gamma-spectrometrical measurements in-situ of natural waters in Bulgaria, 9:50578 (RA;BG;In Bulgarian)
SURFACES
Electron Collisions
Comments on the image contrast from inelastically scattered electrons, 9:50724 (R;US)
Electron Diffraction
Structure determination of molecular adsorbates with dynamical LEED and HREELS, 9:50745 (R;US)
Ion Scattering Analysis
Low energy ion beam interaction with surfaces and the application to surface analysis, 9:50193 (RA;AU)
Surface structure analysis with LEIS, 9:50194 (RA;AU)
Optical Properties
Survey of the finish characteristics of machined optical surfaces, 9:50365 (R;US)
Structural Chemical Analysis
Low energy ion beam interaction with surfaces and the application to surface analysis, 9:50193 (RA;AU)
Structure of adsorbed monolayers. The surface chemical bond, 9:50744 (R;US)
Surface structure analysis with LEIS, 9:50194 (RA;AU)
SURFACING, HARD
See HARD FACING
SURRY POWER STATION UNIT-2
See SURRY-2 REACTOR
SURRY-2 REACTOR
Gravel Neck, Virginia, USA
Fuel Management
Extended Fuel Burnup Demonstration Program. Summary final report, 9:49770 (R;US)
SURVEILLANCE (RADIOACTIVITY)
See RADIATION MONITORING
SURVEY MONITORS
Design
Generator monitoring and surveillance: workshop proceedings, 9:49747 (R;US)
Performance Testing
Evaluation of a draft standard on performance specifications for health physics instrumentation: results for environmental tests, 9:50486 (R;US)
Standards
Evaluation of a draft standard on performance specifications for health physics instrumentation: results for environmental tests, 9:50486 (R;US)
SURVEY (RADIOACTIVITY)
See RADIATION MONITORING
SUSPENSIONS (FUEL)
See FUEL SLURRIES
SWITCHES
Fabrication
Polymer thick-film conductors and dielectrics for membrane switches and flexible circuitry, 9:50421 (R;US)
SWITZERLAND
Energy Models
Cost-optimized energy supply scenarios for Switzerland and their political marginal conditions, 9:49919 (R;CH;In German)
SYNTHESIS GAS
Catalysis
Metal-zeolite catalysts for the conversion of synthesis gas to selected hydrocarbon products, 9:49582 (BA;US)
Production
Catalysts for gasification of biomass, 9:49586 (R;US)
SYNTHETIC FUELS CORPORATION
Constraints
Synthetic Fuels Corporation's progress in aiding synthetic fuels development, 9:49438 (R;US)
SYNTHETIC FUELS INDUSTRY
Environmental Impacts
Federal efforts to control the environmental and health effects of synthetic fuels development, 9:49928 (R;US)
Health Hazards
Federal efforts to control the environmental and health effects of synthetic fuels development, 9:49928 (R;US)
Permits
Federal efforts to control the environmental and health effects of synthetic fuels development, 9:49928 (R;US)
Waste Water
Proceedings of the third biennial synfuels wastewater workshop, 9:49387 (R;US)
SYNTHINE PROCESS
See FISCHER-TROPSCH SYNTHESIS
SYNTHOIL PROCESS
Catalysts
Coal liquefaction in a synthoil reactor without added catalyst, 9:49374 (J;US)
Coal Liquefaction Plants
Process design and economic evaluation of a conceptual 100,000 bbl/day synthoil plant, 9:49373 (J;US)
Modifications
Coal liquefaction in a synthoil reactor without added catalyst, 9:49374 (J;US)

T

T INVARIANCE
Superfluid ^{3}He. Neutral currents, T invariance, gravitation, 9:50755 (RA;SU;In Russian)
TAILINGS
Solid residue separated in the preparation of various products.
See also MILL TAILINGS
Environmental Transport
Development and application of an iridium tracer for tracking tailings in the central Red Sea, 9:50569 (R;DE)
Marine Disposal
Development and application of an iridium tracer for tracking tailings in the central Red Sea, 9:50569 (R;DE)
Waste Product Utilization
Solid wastes from coal and shale: projections of waste forms and utilization potential, 9:49384 (R;US)
TANDEM ELECTROSTATIC ACCELERATORS
Prior to February 1979, information was indexed to Van de Graaff Accelerators.
Operation
Triangle Universities Nuclear Laboratory annual report, TUNL XXIII, September 1, 1983-June 30, 1984, 9:50820 (R;US)
Uses
High-sensitivity mass spectrometry with a tandem accelerator, 9:50449 (J;IT)
TANDEM MIRRORS
Prior to September 1983 this concept was indexed to TMX DEVICES.

Construction
TASKA-M - a low cost, near term tandem mirror device for fusion technology testing, 9:51033 (R;DE)
Mathematical Models
Theoretical investigations relevant to magnetic fusion research, 9:51003 (R;US)
Theoretical investigations relevant to magnetic fusion research, April 1, 1983-March 31, 1984, 9:51004 (R;US)
Specifications
TASKA-M - a low cost, near term tandem mirror device for fusion technology testing, 9:51033 (R;DE)

TANTALUM
Fluorine 19 Reactions
Fission lifetimes from blocking measurements: ^{19}F bombardment of a thin tantalum crystal, 9:50892 (RA;SU)
Ion Implantation
Energy-dispersion X-ray analysis for investigation of structural transformations in crystals at ion implantation, 9:50126 (RA;SU;In Russian)
Metallurgical Effects
Effect of Ta additions upon in situ prepared Nb_3Sn-Cu superconducting wire, 9:50386 (J;US)
Physical Radiation Effects
Energy-dispersion X-ray analysis for investigation of structural transformations in crystals at ion implantation, 9:50126 (RA;SU;In Russian)
Thermal Stresses
710 reactor program. Progress report No. 17, 9:49784 (R;US)

TANTALUM 181 TARGET
Fluorine 19 Reactions
Neutron emission from accelerating fission fragments, 9:50876 (RA;AU)

TANTALUM 182
Uses
Wear measurements of cutting tools made of hard metal, 9:49573 (R;AT;In German)

TANTALUM SULFIDES
Physical Radiation Effects
Pinning of charge density waves by irradiation induced defects in orthorhombic TaS_3 (Electron irradiation effects), 9:50201 (R;HU)
Plasma Waves
Josephson-type oscillations in a moving charge-density wave interacting with magnetic impurities, 9:50212 (J;US)

TAR SANDS
See OIL SANDS

TARGETS
See also ALUMINIUM 27 TARGET
AMERICIUM 241 TARGET
AMERICIUM 243 TARGET
ANTIMONY 121 TARGET
ANTIMONY 123 TARGET
ARGON 37 TARGET
BARIUM 138 TARGET
BERYLLIUM 9 TARGET
CALCIUM 40 TARGET
CALCIUM 42 TARGET
CALCIUM 48 TARGET
CARBON 12 TARGET
CARBON 13 TARGET
CARBON 14 TARGET
CERIUM 140 TARGET
CHLORINE 37 TARGET
CHROMIUM 52 TARGET
DEUTERIUM TARGET
GOLD 197 TARGET
HELIUM 3 TARGET
KRYPTON 84 TARGET
LEAD 208 TARGET
LITHIUM 6 TARGET
LITHIUM 7 TARGET
LUTETIUM 175 TARGET
MAGNESIUM 24 TARGET
MAGNESIUM 26 TARGET
NEON 20 TARGET
NEPTUNIUM 237 TARGET
NICKEL 58 TARGET
NICKEL 60 TARGET
NITROGEN 14 TARGET
OXYGEN 16 TARGET
OXYGEN 17 TARGET
POLARIZED TARGETS
POTASSIUM 41 TARGET
SAMARIUM 154 TARGET
SILICON 28 TARGET
SULFUR 34 TARGET
TANTALUM 181 TARGET
TELLURIUM 130 TARGET
THORIUM 230 TARGET
THORIUM 232 TARGET
TIN 120 TARGET
TITANIUM 48 TARGET
TITANIUM 50 TARGET
TRITIUM TARGET
TUNGSTEN 182 TARGET
URANIUM 238 TARGET
XENON 132 TARGET
YTTRIUM 89 TARGET
ZIRCONIUM 90 TARGET
Design
Tritium/deuterium gas cell, 9:50465 (R;US)
Fabrication
Evaluation of target purity using various vacuum systems, 9:50460 (R;US)
Meetings
International Nuclear Target Development Society workshop 1983: proceedings, 9:50456 (R;US)

TAU LEPTONS
See TAU PARTICLES

TAU NEUTRINOS
Particle Production
Mass and form factor effects in spectrum and width of the semileptonic decays of charmed mesons, 9:50779 (RA;BG;In Bulgarian)

TAU PARTICLES
Particle Production
Mass and form factor effects in spectrum and width of the semileptonic decays of charmed mesons, 9:50779 (RA;BG;In Bulgarian)
Particle Structure
Limits on tau composite structure from polarized Z^0 decay, 9:50788 (J;US)
Semileptonic Decay
New data on semihadronic decays of the tau lepton, 9:50766 (R;DE)

TAUONS
See TAU PARTICLES

TECHNETIUM COMPLEXES
Structural Chemical Analysis
Isothiocyanato complex of technetium(II). Spectroelectrochemical and single-crystal x-ray structural studies on trans-$[Tc(DPPE)_2(NCS)_2]^0$, where DPPE = 1,2-bis(diphenylphosphino)ethane, 9:50354 (J;US)

TELLURIUM 130 TARGET
Sulfur 32 Reactions
Measurement of the g-factors of high-spin states in ^{158}Er, 9:50884 (RA;AU)

TEM
See ALKYLATING AGENTS

TEM (MICROSCOPY)
See TRANSMISSION ELECTRON MICROSCOPY

TEMPERATURE DISTRIBUTION
Measuring Instruments
Calamity Hollow Mine Fire Project. 3. Instrumentation for combustion monitoring, process control, and data recording. Report of investigations/1984, 9:49415 (R;US)

TENDONS (STRUCTURAL)
See CABLES

TENNESSEE
Mineral Resources
Geologic map and mineral resources summary of the Sewanee Quadrangle, Tennessee, 9:49408 (R;US)

TERRESTRIAL BACKGROUND
See BACKGROUND RADIATION

TERRESTRIAL ECOSYSTEMS
Radiation Monitoring
Results and conclusions from the radiation monitoring around the IRT-2000 nuclear reactor in Sofia for the 1962-1982 period, 9:49828 (RA;BG;In Bulgarian)
Research Programs
Arctic Terrestrial Environmental Research Programs of the Office of Energy Research, Department of Energy: Evaluations and recommendations. Appendix B: Components

of an Arctic Terrestrial Environmental Research Program, 9:50562 (R;US)

TEST FACILITIES
Nondestructive Testing
Operation of the EPRI Nondestructive Evaluation Center. 1983 annual report, 9:49933 (R;US)
Ultrahigh-Speed Photography
Experiment for triggered fragmentation with a molten copper-drop in water, 9:50401 (R;DE;In German)

TETRAMETHYLTETRASELENAFULVALENE
See TMTSF

TEVATRON
Helium Dilution Refrigerators
Commissioning of the Tevatron Satellite Refrigeration system, 9:50471 (BA;US)
Fermilab satellite refrigerator compressors with oil and moisture removal systems, 9:50468 (BA;US)
Refrigerators
Control of the Tevatron Satellite Refrigeration system, 9:50470 (BA;US)
Fermilab's satellite refrigerator expansion engines, 9:50469 (BA;US)
Superconducting Magnets
Commissioning of the Tevatron Satellite Refrigeration system, 9:50471 (BA;US)
Control of the Tevatron Satellite Refrigeration system, 9:50470 (BA;US)

TEXAS
Climates
Consideration of future climatic changes in three geologic settings, 9:49554 (R;US)

TFTR REACTORS
Neutral Atom Beam Injection
Neutral beam current drive in TFTR, 9:51017 (RA;GB)
Pellet Injection
Tritium pellet injection sequences for TFTR, 9:51024 (R;US)

THERMAL ENERGY STORAGE EQUIPMENT
Field Tests
Field testing of aquifer thermal energy storage, 9:49910 (R;US)

THERMAL POLLUTION (AIR)
See AIR POLLUTION

THERMAL POLLUTION (WATER)
See WATER POLLUTION

THERMAL POWER PLANTS
See also COMBINED-CYCLE POWER PLANTS
FOSSIL-FUEL POWER PLANTS
NUCLEAR POWER PLANTS
OCEAN THERMAL POWER PLANTS
REFUSE-FUELED POWER PLANTS
SOLAR THERMAL POWER PLANTS
WOOD-FUEL POWER PLANTS
Economic Analysis
Thermoeconomic analysis of power plants. Final report, 9:50431 (R;US)
Thermal Efficiency
Operating experience with potassium systems, 9:49750 (R;AT)
Thermodynamics
Thermoeconomic analysis of power plants. Final report, 9:50431 (R;US)
Topping Cycles
Operating experience with potassium systems, 9:49750 (R;AT)

THERMAL STORAGE
See HEAT STORAGE

THERMAL STRESSES
Distribution
Analysis of temperature and stress profiles induced by a CW line scanned electron beam in <100> oriented silicon, 9:50249 (BA;NL)

THERMAL WATERS
Chemical Composition
Application of analytical methods for trace elements in geothermal waters. Part 2: Plombieres, Bains-les-Bains, Bourbonne (Vosges). Final report, 9:49724 (R;LU)

THERMOLUMINESCENT DOSEMETERS
Reliability
Determination of the natural gamma background by means of TLD. Some results of the environmental monitoring around the IRT-2000 reactor in Sofia, 9:49831 (RA;BG;In Bulgarian)

THERMONUCLEAR REACTOR COOLING SYSTEMS
Magnetohydrodynamics
Special topics reports for the reference tandem mirror fusion breeder: liquid metal MHD pressure drop effects in the packed bed blanket. Vol. 1, 9:51036 (R;US)
Pressure Drop
Special topics reports for the reference tandem mirror fusion breeder: liquid metal MHD pressure drop effects in the packed bed blanket. Vol. 1, 9:51036 (R;US)

THERMONUCLEAR REACTOR MATERIALS
Swelling
Critical radius and critical number of gas atoms for cavities containing a Van der Waals gas, 9:51018 (R;US)
Voids
Critical radius and critical number of gas atoms for cavities containing a Van der Waals gas, 9:51018 (R;US)

THERMONUCLEAR REACTORS
For use in cases where certain aspects of either hypothetical or real thermonuclear reactors are discussed.
See also TOKAMAK TYPE REACTORS
Tandem Mirrors
TASKA-M - a low cost, near term tandem mirror device for fusion technology testing, 9:51033 (R;DE)

THERMONUCLEAR WEAPONS
See NUCLEAR WEAPONS

THERMOSYPHONS
Heat Transfer
Heat transfer in a closed thermosyphon tube filled with near critical fluid, 9:50404 (R;DE;In German)

THICKNESS GAGES
Accuracy
Method for non contacting gauging of the wall thickness of tubes by backscattering of radiation, 9:50483 (R;AT;In German)

THIN FILMS
Compression
Light scattering studies of lower dimensional colloidal particle and critical fluid systems, 9:50317 (R;US)
Light Scattering
Light scattering studies of lower dimensional colloidal particle and critical fluid systems, 9:50317 (R;US)

THIOALCOHOLS
See THIOLS

THIOETHERS
See SULFIDES

THIOLS
Biochemistry
Effects of cellular non-protein sulfhydryl depletion in radiation induced oncogenic transformation and genotoxicity in mouse C_3H 10T1/2 cells, 9:50616 (J;US)
Radiosensitivity Effects
Effects of cellular non-protein sulfhydryl depletion in radiation induced oncogenic transformation and genotoxicity in mouse C_3H 10T1/2 cells, 9:50616 (J;US)
Removal
Metal/metal oxides as high temperature desulfurization sorbents, 9:49338 (RA;US)

THOREX PROCESS
Criticality
Aqueous chemical reprocessing of HTR fuel, 9:49518 (R;DE)

THORIUM
Absorption Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Activation Analysis
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Emission Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Thorex Process
Aqueous chemical reprocessing of HTR fuel, 9:49518 (R;DE)

THORIUM 228
Autoradiography
Feasibility of the use of nuclear-emulsion techniques in the study of drill core and water samples from the Monticello mill, Monticello, Utah, 9:49568 (R;US)
Lung Clearance
Lung-clearance classification of radionuclides in coal fly ash, 9:49441 (J;GB)
X-Ray Fluorescence Analysis
Lung-clearance classification of radionuclides in coal fly ash, 9:49441 (J;GB)
THORIUM 230
Autoradiography
Feasibility of the use of nuclear-emulsion techniques in the study of drill core and water samples from the Monticello mill, Monticello, Utah, 9:49568 (R;US)
Lung Clearance
Lung-clearance classification of radionuclides in coal fly ash, 9:49441 (J;GB)
Radioecological Concentration
Uranium series disequilibrium measurements at MOL and Whiteshell. Annual progress report for 1983, 9:49530 (R;GB)
X-Ray Fluorescence Analysis
Lung-clearance classification of radionuclides in coal fly ash, 9:49441 (J;GB)
THORIUM 230 TARGET
Neutron Reactions
Measurement of subthreshold fission cross section in ^{230}Th(n,f), 9:50904 (RA;AU)
THORIUM 232
Daughter Products
Activity ratios of thorium daughters in vivo, 9:50556 (R;US)
Lung Clearance
Lung-clearance classification of radionuclides in coal fly ash, 9:49441 (J;GB)
Radioecological Concentration
Gamma-ray emitting radionuclides in environmental samples from the South-West Bulgaria, 9:50558 (RA;BG;In Bulgarian)
Uranium series disequilibrium measurements at MOL and Whiteshell. Annual progress report for 1983, 9:49530 (R;GB)
X-Ray Fluorescence Analysis
Lung-clearance classification of radionuclides in coal fly ash, 9:49441 (J;GB)
THORIUM 232 TARGET
Fluorine 19 Reactions
Neutron emission from accelerating fission fragments, 9:50876 (RA;AU)
Neutron Reactions
Evaluation of (n,n') scatteriung cross sections from 0.8 to 2.5 MeV for higher collective bands of ^{232}Th and ^{238}U in "standard" (CN + DI) and "unified" (Weidenmerller s-matrix) formalisms, 9:50925 (B;US)
THORIUM B
See LEAD 212
THORIUM HYDRIDES
Decomposition
^{57}Fe Moessbauer effect in $ThFe_2$ hydride, 9:50751 (J;US)
Sorptive Properties
^{57}Fe Moessbauer effect in $ThFe_2$ hydride, 9:50751 (J;US)
THORIUM ISOTOPES
See also THORIUM 228
THORIUM 230
THORIUM 232
Gamma Spectroscopy
Gamma-spectrometrical measurements in-situ of natural waters in Bulgaria, 9:50578 (RA;BG;In Bulgarian)
THORIUM OXIDES
Compacting
710 reactor program. Progress report No. 17, 9:49784 (R;US)
THREE MILE ISLAND-2 REACTOR
Dauphin County, Pennsylvania, USA
Reactor Accidents
Raman and luminescence spectroscopy of zirconium oxide with the use of the MOLE microprobe, 9:49854 (R;US)
THYRISTORS
Electrical Faults
Protective circuit for thyristor controlled systems and thyristor converter embodying such protective circuit, 9:50424 (P;US)
Electronic Circuits
Protective circuit for thyristor controlled systems and thyristor converter embodying such protective circuit, 9:50424 (P;US)
Equipment Protection Devices
Protective circuit for thyristor controlled systems and thyristor converter embodying such protective circuit, 9:50424 (P;US)
TIGHT SANDS
See SANDSTONES
TIME-REVERSAL INVARIANCE
See T INVARIANCE
TIN 120 TARGET
Pion Minus Reactions
Dependence of the excitation energy, width, and cross section of the isovector monopole resonance, 9:50878 (J;FR)
Pion Reactions
Excitation of giant resonances in pion charge-exchange reactions, 9:50879 (J;FR)
TIN ALLOYS
Critical Current
Effect of Ta additions upon in situ prepared Nb_3 Sn-Cu superconducting wire, 9:50386 (J;US)
Critical Field
Effect of Ta additions upon in situ prepared Nb_3 Sn-Cu superconducting wire, 9:50386 (J;US)
Superconductivity
Critical current density of bronze-processed multifilamentary Nb_3Sn wires with magnesium addition to the matrix, 9:50141 (J;US)
TIN COMPLEXES
Decomposition
Arrhenius parameters for rearrangement of the neophyl, 1-indanylmethyl, 2-allylbenzyl, and 2-(2-vinylphenyl)ethyl radicals relative to hydrogen abstraction from tributylstannane, 9:50324 (J;US)
TISSUE CULTURES
Morphological Changes
Effects of air pollutants on plant cell tissue cultures, 9:50651 (B;US)
TISSUES
Chemical Analysis
Target damage in MeV ion beam microanalysis of biological tissue, 9:50275 (RA;AU)
Ion Microprobe Analysis
Target damage in MeV ion beam microanalysis of biological tissue, 9:50275 (RA;AU)
Multi-Element Analysis
Application of an alpha particle microbeam to tissue analysis in medicine, 9:50276 (RA;AU)
Proton Microprobe Analysis
Target damage in MeV ion beam microanalysis of biological tissue, 9:50275 (RA;AU)
Radiation Injuries
Application of an alpha particle microbeam to tissue analysis in medicine, 9:50276 (RA;AU)
Target damage in MeV ion beam microanalysis of biological tissue, 9:50275 (RA;AU)
TITANIUM
Nuclear Reaction Analysis
Selected topics in surface analysis by high-energy ion beams, 9:50287 (RA;AU)
Passivation
Photoacoustic spectroscopy at electrode-solution interface, 9:50329 (R;US)
TITANIUM 48 TARGET
Oxygen 16 Reactions
Direct reaction analysis of heavy ion collision from the quasi-elastic to the deep-inelastic regime, 9:50857 (RA;AU)
TITANIUM 50 TARGET
Alpha Reactions
Dynamic density dependence of the alpha-nucleon force in folding models of inelastic scattering of alpha-particles, 9:50865 (R;DE)

TITANIUM ALLOYS
See also ALLOY-IN-100
ALLOY-IN-939
INCONEL 738
TITANIUM BASE ALLOYS
Emission Spectra
Application of heavy-ion-induced x-ray satellite emission to alloys, 9:50149 (J;GB)
X-Ray Spectra
Application of heavy-ion-induced x-ray satellite emission to alloys, 9:50149 (J;GB)
TITANIUM BASE ALLOYS
Fracture Properties
Boron-induced toughness loss in Ti-6A1-2Nb-1Ta-0.8Mo, 9:50107 (R;US)
Ion Implantation
Ion implantation of surgical Ti-6Al-4V alloy, 9:50590 (R;US)
Mechanical Properties
Microstructure and mechanical properties of titanium alloys, 9:50137 (R;DE;In German)
Microstructure
Microstructure and mechanical properties of titanium alloys, 9:50137 (R;DE;In German)
TITANIUM BORIDES
Electron Spectroscopy
Reliability of the quantification of EELS measurements, 9:50158 (R;US)
Ion Implantation
Surface mechanical properties and wear behavior of ion implanted TiB_2, 9:50159 (R;US)
Purification
Method for removing oxide contamination from titanium diboride powder, 9:50166 (P;US)
TITANIUM CARBIDES
Electron Spectroscopy
Reliability of the quantification of EELS measurements, 9:50158 (R;US)
Grain Growth
Investigation of the growth kinetics of metal carbide systems (WC-Co; TiC-Co; TiC-Ni), 9:50170 (TJ;US)
TITANIUM SILICIDES
Chemical Vapor Deposition
Fabrication of ceramic-ceramic composites by chemical vapor deposition (SiC-$TiSi_2$), 9:50173 (R;US)
TLD (DOSEMETERS)
See THERMOLUMINESCENT DOSEMETERS
TLD SYSTEMS
See THERMOLUMINESCENT DOSEMETERS
TMTSF
Structural Chemical Analysis
Synthetic metals based on tetramethyltetraselenafulvalene(TMTSF): varied anisotropy in the low temperature (125K) structures of $(TMTSF)_2X$, X = ClO_4^-, PF_6^-, and AsF_6^-, 9:50315 (J;GB)
TOKAMAK DEVICES
See also ALCATOR DEVICE
DITE TOKAMAK
FT TOKAMAK
JFT-2 TOKAMAK
Beam Injection
Progress report on negative ion beams based on User Development Workshop on negative ion based neutral beams, 15-16 February, 1983, Princeton, 9:51016 (RA;GB)
Beam Injection Heating
Current drive by ICRF heating of alpha-particles and beam ions, 9:50984 (RA;GB)
Current-Drive Heating
Non-inductive current drive in tokamaks, 9:51000 (R;GB)
Optimization of tokamak reactors with beam-driven current, 9:51014 (RA;GB)
High-Frequency Heating
Plasma heating and current drive in a tokamak by the fast mode of low hybrid waves, 9:50995 (RA;GB)
ICR Heating
Current drive by ICRF heating of alpha-particles and beam ions, 9:50984 (RA;GB)
Minority ICRF current drive in toroidal geometry, 9:50983 (RA;GB)
Neutral Atom Beam Injection
Optimization of tokamak reactors with beam-driven current, 9:51014 (RA;GB)
Optimization
Optimization of tokamak reactors with beam-driven current, 9:51014 (RA;GB)
Research Programs
Wills Plasma Physics Department annual progress report, 9:51007 (R;AU)
TOKAMAK FUSION TEST REACTOR
See TFTR REACTORS
TOKAMAK TYPE REACTORS
See also INTOR TOKAMAK
ISX TOKAMAK
JT-60 REACTORS
PLT DEVICES
STARFIRE TOKAMAK
TFTR REACTORS
Cost
Impact of maximum TF magnetic field on performance and cost of an advanced physics tokamak, 9:51025 (R;US)
Design
Advanced performance fusion engineering device based on low safety factor and current drive (FED-A), 9:51022 (R;US)
Magnet Coils
Impact of maximum TF magnetic field on performance and cost of an advanced physics tokamak, 9:51025 (R;US)
TOLUENE
Chemical Reaction Kinetics
Reactive scattering of $O(^3P)$ with toluene, 9:50321 (J;US)
Dealkylation
Zinc ferrite hydrogen sulfide absorbent, 9:49340 (RA;US)
Removal
Zinc ferrite hydrogen sulfide absorbent, 9:49340 (RA;US)
TOP ACCIDENTS
See TRANSIENT OVERPOWER ACCIDENTS
TOTAL ENERGY SYSTEMS
Cogeneration
Analysis of the technical and energetical operation behavior of cogeneratiOn plants, 9:50053 (R;DE;In German)
Computerized Simulation
Analysis of the technical and energetical operation behavior of cogeneratiOn plants, 9:50053 (R;DE;In German)
Field Tests
Analysis of the technical and energetical operation behavior of cogeneratiOn plants, 9:50053 (R;DE;In German)
TOTAL-ABSORPTION SPECTROMETERS
See SHOWER COUNTERS
TOUGHNESS (FRACTURE)
See FRACTURE PROPERTIES
TOWER FOCUS POWER PLANTS
See also BARSTOW SOLAR PILOT PLANT
Brayton Cycle Power Systems
Small Brayton central receiver systems for remote industrial power generation, 9:49676 (BA;US)
Central Receivers
Small Brayton central receiver systems for remote industrial power generation, 9:49676 (BA;US)
Steam Generators
Molten salt steam generator subsystem research experiment: executive summary. Phase 1, final report, 9:49672 (R;US)
Molten salt steam generator subsystem research experiment: executive summary. Phase I. Specification and preliminary design. Final report, 9:49673 (R;US)
TOXIC MATERIALS
See also TOXINS
Mutagen Screening
Use of cytogenetic endpoints in human lymphocytes as indicators of exposure to genotoxicants, 9:50630 (R;US)
TOXICITY
Research Programs
Radiation, chemicals, and occupational health research, 9:50605 (R;US)
TOXINS
Waste Processing
Immobilization of toxic waste by embedding into bitumen, 9:50057 (R;AT;In German)

TRACK DETECTORS (DIELECTRIC)
See DIELECTRIC TRACK DETECTORS
TRACK DETECTORS (GAS)
See GAS TRACK DETECTORS
TRACKS
See PARTICLE TRACKS
TRANSFER FUNCTIONS
Analytical Solution
Solving of inverse Z-transfer function by recurrent permutation method, 9:50978 (R;TW)
TRANSFER (HEAT)
See HEAT TRANSFER
TRANSFER (IN ENVIRONMENT)
See RADIONUCLIDE MIGRATION
TRANSFER (IN ORGANISM)
See RADIONUCLIDE KINETICS
TRANSFORMATIONS (ONCOGENIC)
See ONCOGENIC TRANSFORMATIONS
TRANSIENT OVERPOWER ACCIDENTS
Computerized Simulation
Physical models and numerical methods of the reactor dynamic computer program RETRAN, 9:49895 (R;AT;In German)
TRANSITION ELEMENT COMPOUNDS
See also COPPER COMPOUNDS
IRON COMPOUNDS
NIOBIUM COMPOUNDS
RUTHENIUM COMPOUNDS
Catalytic Effects
Catalytic coal gasification, 9:49359 (R;GB)
TRANSITION ELEMENTS
See also CHROMIUM
COBALT
COPPER
GOLD
IRON
MANGANESE
MOLYBDENUM
NICKEL
NIOBIUM
RHENIUM
SCANDIUM
SILVER
TANTALUM
TITANIUM
TUNGSTEN
VANADIUM
Absorption Spectra
Spectroscopic studies of transition metal ions in molten alkali metal carboxylates, 9:50331 (J;US)
NMR Spectra
Spectroscopic studies of transition metal ions in molten alkali metal carboxylates, 9:50331 (J;US)
TRANSITION METALS
See TRANSITION ELEMENTS
TRANSMISSION ELECTRON MICROSCOPY
Uses
Transmission electron microscopy of inorganic materials, 9:50092 (R;US)
TRANSMISSION (HEAT)
See HEAT TRANSFER
TRANSMISSION LINES
See POWER TRANSMISSION LINES
TRANSPORT (CHARGED-PARTICLE)
See CHARGED-PARTICLE TRANSPORT
TRANSPORT (GAMMA)
See PHOTON TRANSPORT
TRANSPORT (IN ORGANISMS)
See RADIONUCLIDE KINETICS
TRANSPORT (PHOTON)
See PHOTON TRANSPORT
TRANSPORTATION SECTOR
Energy Analysis
Incorporating energy analysis in the transportation improvement program process, 9:50031 (R;US)
Energy Conservation
Incorporating energy conservation into the transportation planning process: mid-sized areas, 9:50030 (R;US)
Energy Consumption
Transportation energy use and efficiency in Tunisia, 9:50032 (R;US)
Energy Demand
Energy demand in the transportation sector of Mexico, 9:49944 (R;US)
Energy Expenses
Appendices A, B, and C of the methodology for life cycle cost analysis using average fuel costs, 9:49955 (R;US)
Fuel Consumption
Transportation energy use and efficiency in Tunisia, 9:50028 (R;US)
Planning
Incorporating energy conservation into the transportation planning process: mid-sized areas, 9:50030 (R;US)
TRANSPORTATION SYSTEMS
Mathematical Models
Predictive intercity freight network models: The state-of-the-art, 9:50033 (J;GB)
TRANSURANIUM ELEMENTS
See also PLUTONIUM
Production
Transuranium Processing Plant report of production, status, and plans for October 1, 1980-March 31, 1983, 9:50350 (R;US)
TRANSURANIUM WASTES
See ALPHA-BEARING WASTES
TREES
Plant Growth
Comparison of tree growth models, 9:50548 (R;US)
Simulating responses to expected climate change in eastern North America: applications to decision-making in the forest industry, 9:50547 (R;US)
TRETAMINE
See ALKYLATING AGENTS
TRIETHYLENEMELAMINE
See ALKYLATING AGENTS
TRIPHENYLENE
Crystal Structure
Synchrotron x-ray study of the orientational ordering D2-D1 structural phase transition of freely suspended discotic strands in triphenylene hexa-n-dodecanoate, 9:50320 (J;US)
Crystal-Phase Transformations
Synchrotron x-ray study of the orientational ordering D2-D1 structural phase transition of freely suspended discotic strands in triphenylene hexa-n-dodecanoate, 9:50320 (J;US)
TRIPLET PARTICLES
See QUARKS
TRITIATED COMPOUNDS
See TRITIUM COMPOUNDS
TRITIUM
Fusion Reactions
Experimental study of muon-catalyzed fusion in low-density deuterium-tritium gas, 9:50752 (J;US)
Muonic Atoms
Experimental study of muon-catalyzed fusion in low-density deuterium-tritium gas, 9:50752 (J;US)
Targets
Tritium/deuterium gas cell, 9:50465 (R;US)
TRITIUM COMPOUNDS
Isotope Ratio
Program for TI programmable 59 calculator for calculation of ^3H concentration of water samples, 9:50351 (R;PK)
TRITIUM TARGET
Photonuclear Reactions
Measurement of coherent π^0 photoproduction on ^3He and ^3H in the resonance region, 9:50828 (R;DE)
TRU WASTES
See ALPHA-BEARING WASTES
TRYPAFLAVINE
See ACRIFLAVINE
TSL PROCESS
Organic Solvents
Advanced research for the characterization of hydrogen donor solvents in two-stage liquefaction. Quarterly report, April 1, 1984-June 30, 1984, 9:49356 (R;US)

Yields
Nonintegrated two-stage coal liquefaction: the Wilsonville Advanced Coal Liquefaction R and D Facility, Wilsonville, Alabama. Final report, 9:49358 (R;US)

TUBES
For objects of tubular shape; not for DRIFT TUBES, ELECTRON TUBES or IMAGE STORAGE TUBES.
Dryout
Experimental investigation of post dryout heat transfer, 9:49885 (R;SE)
Heat Transfer
Experimental investigation of post dryout heat transfer, 9:49885 (R;SE)

TUBES (CONDUITS)
See PIPES

TUMORS
See NEOPLASMS

TUNGSTEN
Nitrogen 14 Reactions
Near-threshold production of neutral π mesons in heavy-ion reactions, 9:50848 (R;US)
Physical Radiation Effects
Simulation of nuclear reaction duration on measurement at substantial radiation damage of monocrystal (^{40}Ar radiation damage on tungsten), 9:50127 (RA;SU;In Russian)
Proton Channeling
Dependence of characteristic X-radiation emission effective depth from type of dechanneling differential function, 9:50124 (RA;SU;In Russian)
X-Ray Spectra
Dependence of characteristic X-radiation emission effective depth from type of dechanneling differential function, 9:50124 (RA;SU;In Russian)

TUNGSTEN 168
Backbending
Long lifetimes and moments through the backbend in ^{168}W, 9:50886 (RA;AU)
Yrast States
Long lifetimes and moments through the backbend in ^{168}W, 9:50886 (RA;AU)

TUNGSTEN 178
Heavy Ion Reactions
Heavy ion induced fission reactions, 9:50891 (RA;AU)
Neutron evaporation following heavy ion reactions for systems with $150 < A < 190$, 9:50883 (RA;AU)

TUNGSTEN 182
Rotational States
Inelastic scattering of intermediate energy protons from tungsten, 9:50885 (RA;AU)

TUNGSTEN 182 TARGET
Proton Reactions
Inelastic scattering of intermediate energy protons from tungsten, 9:50885 (RA;AU)

TUNGSTEN BASE ALLOYS
Corrosion Protection
Method for preparing surfaces of metal composites having a brittle phase for plating, 9:50148 (P;US)
Embrittlement
Interphase boundary precipitation in liquid phase sintered W-Ni-Fe and W-Ni-Cu alloys, 9:50145 (J;US)
Etching
Method for preparing surfaces of metal composites having a brittle phase for plating, 9:50148 (P;US)
Shot Peening
Method for preparing surfaces of metal composites having a brittle phase for plating, 9:50148 (P;US)
Surface Treatments
Method for preparing surfaces of metal composites having a brittle phase for plating, 9:50148 (P;US)
Thermal Stresses
710 reactor program. Progress report No. 17, 9:49784 (R;US)

TUNGSTEN CARBIDES
Grain Growth
Investigation of the growth kinetics of metal carbide systems (WC-Co; TiC-Co; TiC-Ni), 9:50170 (TJ;US)
Precipitation
Precipitation of the W_2C semicarbide of tungsten in tungsten sheets, 9:50169 (TJ;US)

TUNISIA
Transportation Sector
Transportation energy use and efficiency in Tunisia, 9:50032 (R;US)
Transportation energy use and efficiency in Tunisia, 9:50028 (R;US)

TURBINE BLADES
Stress Analysis
Thermal stress analysis for a wood composite blade, 9:49737 (R;US)

TURBINES
See also GAS TURBINES
STEAM TURBINES
WIND TURBINES
Energy Efficiency
Increase of efficiency in cooled high temperature turbines. Phase I, 9:50069 (R;DE;In German)

TURBOGENERATORS
Start-Up
Solar One turbine-generator, turbine 197845 start-up checklist, 9:49670 (R;US)

TURNOVER (RADIONUCLIDES)
See RADIONUCLIDE KINETICS

TWO-PHASE FLOW
Analytical Solution
Gas injection in heterogeneous reservoirs. Analytical solution No. 1, 9:49450 (R;NO)
Computer Calculations
Assessment of feedability of Kerr-McGee ash concentrate, 9:49345 (R;US)
Integral Equations
Gas injection in heterogeneous reservoirs. Analytical solution No. 1, 9:49450 (R;NO)

TYPE-II SUPERCONDUCTORS
Reviews
Advanced superconducting materials, 9:50129 (R;DE)

TYPE-III SUPERCONDUCTORS
See TYPE-II SUPERCONDUCTORS

U

U-1 GROUPS
Symmetry Breaking
Chiral symmetry and the U(1) problem, 9:50795 (RA;AU)

UCLBL
See LAWRENCE BERKELEY LABORATORY

UCLLL
See LAWRENCE LIVERMORE LABORATORY

UJM
See JET MODEL

ULTRACENTRIFUGE ENRICHMENT PLANTS
See CENTRIFUGE ENRICHMENT PLANTS

ULTRASONIC TESTING
Ultrasonic girth weld evaluation for aluminum substrate of spherical Kevlar-epoxy test specimens, 9:50418 (R;US)
Focusing
Emerging technology of synthetic aperture focusing for ultrasonic testing, 9:49814 (R;US)
Image Processing
Use of the analytic signal in ultrasonic imaging, 9:50417 (R;US)
Mathematical Models
Modeling of real UT transducer field/flaw interactions, 9:50410 (R;US)
Signal Conditioning
Use of the analytic signal in ultrasonic imaging, 9:50417 (R;US)
Spherical Model
Ultrasonic analysis of spherical composite test specimens, 9:50416 (R;US)

UNCORRELATED-JET MODEL
See JET MODEL

UNDERGROUND GASIFICATION
See IN-SITU GASIFICATION

UNDERGROUND HEAT DISTRIBUTION SYSTEMS
See HEAT DISTRIBUTION SYSTEMS

UNDERGROUND MINING
See also ROOM AND PILLAR MINING
Abandoned Sites
Calamity Hollow Mine Fire Project. 3. Instrumentation for combustion monitoring, process control, and data recording. Report of investigations/1984, 9:49415 (R;US)
Hazards
Geologic factors in coal mine roof stability--a progress report. Information circular/1984 (Effects of moisture), 9:49416 (R;US)
Mine Rescue
Technical equipment for rescuing injured miners in case of roof breaks in coal faces and roadways, 9:49439 (R;DE;In German)
Mining Equipment
Extension of low coal canopy technology to include drilling and cutting machines. Open file report 19 December 1980-15 June 1983, 9:49417 (R;US)
Power Systems
Electric arcing at high voltage during methane-air explosions inside explosion-proof enclosures. Technical progress report, 9:50364 (R;US)
Roofs
Geologic factors in coal mine roof stability--a progress report. Information circular/1984 (Effects of moisture), 9:49416 (R;US)

UNDERWATER FACILITIES
Control Systems
High reliability instrumentation systems (Subsea control system for monitoring well heads), 9:50436 (R;NO;In Norwegian)

UNIFIED GAUGE MODELS
See also GRAND UNIFIED THEORY
Lattice Field Theory
Definition and general properties of the transfer matrix in continuum limit improved lattice gauge theories, 9:50802 (R;DE)

UNIPOLAR TRANSISTORS
See FIELD EFFECT TRANSISTORS

UNITARITY
K Matrix
Unitarity and K-matrix model fitting, 9:50909 (RA;AU)

UNITED STATES OF AMERICA
See USA

UNIVERSE
Expansion
Quark hadron phase transition in bianchi type I cosmologies, 9:50672 (R;IT)
Grand Unified Theory
Models which allow a "new inflationary" universe history, 9:50708 (J;US)

UNIVERSITY OF CALIFORNIA LAWRENCE RADIATI
See LAWRENCE BERKELEY LABORATORY

UPSILON RESONANCES
Lectures
Introduction to ν quarkonium physics, 9:50776 (R;DE)
Particle Production
Introduction to ν quarkonium physics, 9:50776 (R;DE)
Particle Properties
Introduction to ν quarkonium physics, 9:50776 (R;DE)

UPWELLING
Salinity Gradients
An artificial upwelling driven by salinity differences in the ocean, 9:49679 (BA;US)

URANIUM
See also ENRICHED URANIUM
NATURAL URANIUM
Absorption Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Activation Analysis
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Adsorption
Influence of adsorber performance on plant design for the extraction of uranium from seawater, 9:49508 (R;DE)
Emission Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Pilot Plants
Design of a modular pilot plant based on the adsorber loop concept, 9:49514 (R;DE)
Production
Absorber loop concept for the contact between seawater and adsorber granulate, 9:49513 (R;DE)
Design of a modular pilot plant based on the adsorber loop concept, 9:49514 (R;DE)
Some economic considerations for a pilot plant based on the adsorber loop concept, 9:49525 (R;DE)
Technological-economic considerations of the production of uranium by the amalgam process, 9:49509 (TJ;US)
Recovery
Absorber loop concept for the contact between seawater and adsorber granulate, 9:49513 (R;DE)
Design of a modular pilot plant based on the adsorber loop concept, 9:49514 (R;DE)
Influence of adsorber performance on plant design for the extraction of uranium from seawater, 9:49508 (R;DE)
Some economic considerations for a pilot plant based on the adsorber loop concept, 9:49525 (R;DE)
Thorex Process
Aqueous chemical reprocessing of HTR fuel, 9:49518 (R;DE)

URANIUM 234
Radioecological Concentration
Methods and results of EPA's study of radon in drinking water, 9:50576 (R;US)
Uranium content in surface air in Vienna during the years 1963/64 and 1974 - 1978, 9:50541 (R;AT;In German)
Uranium series disequilibrium measurements at MOL and Whiteshell. Annual progress report for 1983, 9:49530 (R;GB)

URANIUM 235
Radioecological Concentration
Uranium content in surface air in Vienna during the years 1963/64 and 1974 - 1978, 9:50541 (R;AT;In German)

URANIUM 238
Lung Clearance
Lung-clearance classification of radionuclides in coal fly ash, 9:49441 (J;GB)
Radioecological Concentration
Gamma-ray emitting radionuclides in environmental samples from the South-West Bulgaria, 9:50558 (RA;BG;In Bulgarian)
Methods and results of EPA's study of radon in drinking water, 9:50576 (R;US)
Uranium content in surface air in Vienna during the years 1963/64 and 1974 - 1978, 9:50541 (R;AT;In German)
Uranium series disequilibrium measurements at MOL and Whiteshell. Annual progress report for 1983, 9:49530 (R;GB)
X-Ray Fluorescence Analysis
Lung-clearance classification of radionuclides in coal fly ash, 9:49441 (J;GB)

URANIUM 238 TARGET
Neutron Reactions
Evaluation of (n,n') scatteriung cross sections from 0.8 to 2.5 MeV for higher collective bands of ^{233}Th and ^{238}U in "standard" (CN + DI) and "unified" (Weidenmerller s-matrix) formalisms, 9:50925 (B;US)

URANIUM BASE ALLOYS
Thermodynamic Properties
Thermodynamic properties of gamma-uranium in the formation of solid solutions with alpha-transition metals, 9:50150 (TG;US)

URANIUM CONCENTRATES
Production
Mining-metallurgical projects for the production of uranium concentrates, 9:49507 (R;MX;In Spanish)

URANIUM DIOXIDE
Chemical Reactions
Chemical interactions between UO_2 and zircaloy-4 from 1000 to 2000°C, 9:49867 (RA;DE;In German)
Compacting
710 reactor program. Progress report No. 17, 9:49784 (R;US)

Creep
710 reactor program. Progress report No. 17, 9:49784 (R;US)
Dissolution
Dissolution of unirradiated UO_2-pellets in nitric acid, 9:49521 (R;DE;In German)
Fuel-Cladding Interactions
Chemical interactions between UO_2 and zircaloy-4 from 1000 to 2000°C, 9:49867 (RA;DE;In German)
URANIUM HEXAFLUORIDE
Monitoring
Quantitative determination of uranium discharges in vent stack gases, 9:49565 (R;US)
URANIUM II
See URANIUM 234
URANIUM ISOTOPES
See also URANIUM 234
URANIUM 235
URANIUM 238
Gamma Spectroscopy
Gamma-spectrometrical measurements in-situ of natural waters in Bulgaria, 9:50578 (RA;BG;In Bulgarian)
Separation Nozzle Method
Accuracy of X-ray lithography using synchrotron radiation for the fabrication of technical separation nozzle elements, 9:49511 (R;DE;In German)
URANIUM MILLS
See FEED MATERIALS PLANTS
URANUS PLANET
Planetary Magnetospheres
A radiometric Bode's Law: Predictions for Uranus, 9:50701 (R;US)
URR REACTOR
Reactor Operation
Annual report 1982-83, 9:49836 (R;GB)
Research Programs
Annual report 1982-83, 9:49836 (R;GB)
US DOE
See also ANL
BNL
BONNEVILLE POWER ADMINISTRATION
HANFORD RESERVATION
LAWRENCE BERKELEY LABORATORY
LAWRENCE LIVERMORE LABORATORY
SAVANNAH RIVER PLANT
WIPP
Administrative Procedures
Energy emergency preparedness. Hearings before the Subcommittee on Fossil and Synthetic Fuels of the Committee on Energy and Commerce, House of Representatives, Ninety-Eighth Congress, Second Session, February 1, 2, and 21, 1984, 9:49470 (B;US)
Audits
Revenues derived from work performed for non-federal entities (Albuquerque, Nevada, and Richland Operations Offices and The Western Area Power Administration), 9:49923 (R;US)
Budgets
Uranium enrichment policy. Hearings before the Subcommittee on Energy Conservation and Power of the Committee on Energy and Commerce, House of Representatives, Ninety-Eighth Congress, October 21, 1983 and March 1, 1984, 9:49512 (B;US)
Financing
Department-wide review of advance financing by letter of credit, 9:51046 (R;US)
Regulations
Safety analysis and review system (SARS), 9:49932 (R;US)
Research Programs
Annual report and summaries of FY 1984 activities supported by the Division of Biological Energy Research, 9:49606 (R;US)
Summaries of physical research in the geosciences, 9:50654 (R;US)
US DOI
Regulations
Identification of changes introduced under the proposed OCS leasing schedule, 9:49467 (R;US)
US EPA
Federal Assistance Programs
EPA's innovative technology program for waste water treatment needs better controls, 9:49929 (R;US)
US FEMA
Further actions needed to improve emergency preparedness around nuclear powerplants, 9:49855 (R;US)
US NRC
United States Nuclear Regulatory Commission-prior to 1975 was part of US AEC.
Antitrust Review
Nuclear Regulatory Commission's antitrust review process: an analysis of the impacts, 9:49934 (R;US)
Document Types
Nuclear Regulatory Commission issuances. Vol. 19, No. 5, 9:49785 (R;US)
Nuclear Regulatory Commission issuances, June 1984. Volume 19, No. 6, 9:49786 (R;US)
License Applications
Nuclear Regulatory Commission's antitrust review process: an analysis of the impacts, 9:49934 (R;US)
Research Programs
U.S.N.R.C. research on severe accidents and other safety matters, 9:49863 (RA;DE)
US WATER POLLUTION CONTROL ACT
See CLEAN WATER ACT
USA
See also FEDERAL REGION III
FEDERAL REGION X
GREAT BASIN
Coal Industry
Annual outlook for US coal, 1984: with projections to 1995, 9:49436 (R;US)
Energy: challenges and opportunities for the Middle Atlantic United States. Volume 2. Background articles, 9:49917 (R;US)
How rapidly can production and use of eastern coal be expanded, 9:49411 (RA;US)
Coal Reserves
How rapidly can production and use of eastern coal be expanded, 9:49411 (RA;US)
Continental Shelf
Summary of United States-Canada and United States-Mexico maritime boundary disputes in relationship to hydrocarbon resources, 9:49469 (R;US)
Energy Expenses
Appendices A, B, and C of the methodology for life cycle cost analysis using average fuel costs, 9:49955 (R;US)
Energy Shortages
Has the energy crisis passed (1973 to about 2000; US, OPEC and global aspects), 9:49946 (RA;US)
Energy Supplies
Energy: challenges and opportunities for the Middle Atlantic United States. Volume 2. Background articles, 9:49917 (R;US)
Government Policies
Post-war energy economics: the urban and regional implications, 9:49921 (RA;US)
Weather
Weather data for simplified energy calculation methods. Volume IV. United States: WYEC data, 9:50022 (R;US)
Weather data for simplified energy calculation methods. Volume II. Middle United States: TRY data, 9:50020 (R;US)
Weather data for simplified energy calculation methods. Volume I. Eastern United States: TRY data, 9:50019 (R;US)
Weather data for simplified energy calculation methods. Volume III. Western United States: TRY data, 9:50021 (R;US)
UTAH
Climates
Consideration of future climatic changes in three geologic settings, 9:49554 (R;US)
UTILITIES
See ELECTRIC UTILITIES

V

VACUUM SYSTEMS
Cooling Systems
Heating and cooling systems for JT-60 Vacuum Vessel, 9:51044 (BA;US)
Heating Systems
Heating and cooling systems for JT-60 Vacuum Vessel, 9:51044 (BA;US)
VALENCE ELECTRONS
See ELECTRONS
VALVES
Materials
Evaluation of low-cobalt alloys for hardfacing applications in nuclear components. Final report, 9:49803 (R;US)
VAN ALLEN BELTS
See RADIATION BELTS
VANADIUM
Ion Implantation
Energy-dispersion X-ray analysis for investigation of structural transformations in crystals at ion implantation, 9:50126 (RA;SU;In Russian)
Physical Radiation Effects
Energy-dispersion X-ray analysis for investigation of structural transformations in crystals at ion implantation, 9:50126 (RA;SU;In Russian)
VANADIUM ALLOYS
See also ALLOY-IN-100
Emission Spectra
Application of heavy-ion-induced x-ray satellite emission to alloys, 9:50149 (J;GB)
Fabrication
Design of ordered intermetallic alloys for high-temperature structural use (Ni_3V-CO_3V-Fe_3V; Ni_3Al), 9:50096 (R;US)
Ion Implantation
Ion implantation of surgical Ti-6Al-4V alloy, 9:50590 (R;US)
Mechanical Properties
Design of ordered intermetallic alloys for high-temperature structural use (Ni_3V-CO_3V-Fe_3V; Ni_3Al), 9:50096 (R;US)
Thermodynamic Properties
Thermodynamic properties of gamma-uranium in the formation of solid solutions with alpha-transition metals, 9:50150 (TG;US)
X-Ray Spectra
Application of heavy-ion-induced x-ray satellite emission to alloys, 9:50149 (J;GB)
VANADIUM MINERALS
See MINERALS
VAPORS
Explosions
Experiment for triggered fragmentation with a molten copper-drop in water, 9:50401 (R;DE;In German)
VECTOR FIELDS
Gauge Invariance
Path-integral derivation of the chiral anomalies of Dirac fermions coupled to gauge and gravitational fields in even space-time dimensions, 9:50813 (J;US)
VECTOR MESONS
Hadronic Particle Decay
1sup(+-+) resonances in $\gamma\gamma$ collisions, 9:50790 (J;IT)
Photoproduction
1sup(+-+) resonances in $\gamma\gamma$ collisions, 9:50790 (J;IT)
Radiative Decay
1sup(+-+) resonances in $\gamma\gamma$ collisions, 9:50790 (J;IT)
VEHICLES
See also AUTOMOBILES
ELECTRIC-POWERED VEHICLES
SPACE VEHICLES
Energy Conservation
Possibilities to improve the efficiency of power transmission, 9:50086 (RA;DD;In German)
Exhaust Gases
Investigations into the emissions effects of vehicle misfueling, 9:50532 (R;US)
Mechanical Transmissions
Possibilities to improve the efficiency of power transmission, 9:50086 (RA;DD;In German)
VESSELS (CHEMICAL REACTIONS)
See CHEMICAL REACTORS
VESSELS (PRESSURE)
See PRESSURE VESSELS
VIRUSES
Environmental Transport
Virus entrainment in a glacial aquifer, 9:50566 (R;US)
VISITOR CENTERS
See PUBLIC BUILDINGS
VITRIFICATION
Cost
Nuclear waste glass composition limitations (Effects of reprocessing plant flowsheets on cost of vitrification), 9:49557 (R;US)
VITRINITE
See MACERALS
VOLCANOES
See also KILAUEA VOLCANO
Air Pollution
First estimate of annual mercury flux at the Kilauea main vent, 9:50536 (J;GB)
VOLTAIC CELLS
See ELECTRIC BATTERIES

W

WALKER CARCINOMA
See EXPERIMENTAL NEOPLASMS
WASTE ISOLATION PILOT PLANT
See WIPP
WASTE PROCESSING
See also ACTIVATED SLUDGE PROCESS
ANAEROBIC DIGESTION
RADIOACTIVE WASTE PROCESSING
Technology Assessment
EPA's innovative technology program for waste water treatment needs better controls, 9:49929 (R;US)
WASTE TREATMENT
See WASTE PROCESSING
WASTE WATER
Chemical Composition
Organic and inorganic mercury species in the Ft. Lewis solvent refined coal pilot plant water treatment process. Technical report, 9:49361 (R;US)
Chlorination
Chemistry and fate of disinfection by-products, 9:50568 (R;US)
Corrosive Effects
Gasification wastewater treatment and reuse, 9:49331 (RA;US)
Denitration
Microbial degradation of high nitrogen contents (primarily nitrate) in industrial waste water, 9:50598 (R;DE;In German)
Meetings
Proceedings of the third biennial synfuels wastewater workshop, 9:49387 (R;US)
Recycling
Gasification wastewater treatment and reuse, 9:49331 (RA;US)
Waste Heat Utilization
Waste heat recovery from waste water with a heat pump for 400 flats in Falun. Project plan, 9:50063 (R;SE;In Swedish)
Waste Processing
Proceedings of the third biennial synfuels wastewater workshop, 9:49387 (R;US)
Water Treatment
Evaluation of two conceptual wastewater treatment schemes for a Lurgi-based indirect coal liquefaction plant, 9:49360 (R;US)
Gasification wastewater treatment and reuse, 9:49331 (RA;US)
Organic and inorganic mercury species in the Ft. Lewis solvent refined coal pilot plant water treatment process. Technical report, 9:49361 (R;US)

Sour water stripping of coal gasification waste water. Final report, 9:49386 (R;US)

WASTE-FUELED POWER PLANTS
See REFUSE-FUELED POWER PLANTS

WASTE-ROCK INTERACTIONS
Mathematical Models
Programme of research into the management and storage of radioactive waste. Mathematical modelling. Annual report 1983, 9:49529 (R;GB)

WATER
See also GROUND WATER
HEAVY WATER
RAIN WATER
SEAWATER
WASTE WATER
Chemical Reaction Kinetics
The behavior of water in molten salts, 9:50332 (J;US)
Diffusion
Interface movement in salt-gradient solar ponds, 9:49711 (BA;US)
Neutron Transport
Theoretical and experimental investigation on neutron transport in moderating and shielding materials, 9:50930 (RA;BG;In Bulgarian)
Particle Tracks
Studies of charged-particle tracks in liquid water, 9:50926 (R;US)
Phase Studies
Sour water stripping of coal gasification waste water. Final report, 9:49386 (R;US)
Photon Transport
Vacuum ultraviolet electronic properties of liquids. Annual progress report, February 1, 1984-January 31, 1985, 9:50927 (R;US)
Sampling
Exploration for tritium-free water, 9:50352 (R;PK)

WATER COOLANT
See WATER

WATER COOLED REACTORS
See also BWR TYPE REACTORS
HFIR REACTOR
LR-0 REACTOR
ORR REACTOR
PWR TYPE REACTORS
Failed Element Monitors
Water-level and fuel-failure external monitoring, 9:49850 (R;US)
Fuel-Cladding Interactions
Investigations on temperature escalation under severe fuel damage conditions, 9:49880 (RA;DE;In German)
In Core Instruments
Water-level and fuel-failure external monitoring, 9:49850 (R;US)
Level Indicators
Water-level and fuel-failure external monitoring, 9:49850 (R;US)
Loss of Coolant
HTCC - a heat transfer model for gas-steam mixtures, 9:49846 (R;DE;In German)
Reactor Accidents
Geometric radiation exchange factors for axial radiative transfer in an LWR core filled with absorbing-emitting gases, 9:49852 (R;US)
Reactor Components
Trends in the development of new pipe systems for power plants, 9:49856 (RA;DE;In German)
Reactor Safety
Light water reactor hydrogen safety research in the United States, 9:49865 (RA;DE)

WATER CURRENTS
Measuring Instruments
Directional wave spectra from the Frigg Field in the North Sea, 9:50581 (R;NO)
Recording Systems
Directional wave spectra from the Frigg Field in the North Sea, 9:50581 (R;NO)

WATER GAS PROCESSES
Chemical Reaction Kinetics
Untangling the water gas shift from Fischer-Tropsch: A Gordian knot?, 9:49577 (BA;US)

WATER HEATERS
See also SOLAR WATER HEATERS
Field Tests
Improved efficiency domestic hot water tank field study - installation report - report No. 8A, 9:50010 (R;CA)
Thermal Insulation
Operation wrap-up/seal-up; an inside look, 9:49990 (RA;US)

WATER MODERATOR
See WATER

WATER POLLUTION
Remote Sensing
Feasibility of using fiber optics for monitoring ground water contaminants, 9:50580 (R;US)

WATER QUALITY
Monitoring
Feasibility of using fiber optics for monitoring ground water contaminants, 9:50580 (R;US)

WATER TREATMENT
Comparative Evaluations
Evaluation of two conceptual wastewater treatment schemes for a Lurgi-based indirect coal liquefaction plant, 9:49360 (R;US)

WATER WAVES
Energy Absorption
Hydrodynamic studies on floating attenuator wave energy devices, 9:49732 (R;GB)
Frequency Analysis
Directional wave spectra from the Frigg Field in the North Sea, 9:50581 (R;NO)
Measuring Instruments
Directional wave spectra from the Frigg Field in the North Sea, 9:50581 (R;NO)
Monitoring
Directional wave spectra from the Frigg Field in the North Sea, 9:50581 (R;NO)
Spectral Response
Directional wave spectra from the Frigg Field in the North Sea, 9:50581 (R;NO)

WATERBORNE PARTICLES
See PARTICULATES

WATERFLOODING
Additives
Improved polymers for enhanced oil recovery synthesis and rheology. Sixth annual report, October 1982-September 1983, 9:49447 (R;US)

WATERSHEDS
Hydrology
Floods on Duck River in the vicinity of Centerville, Tennessee, 9:50661 (R;US)
Water Quality
Effects of prescribed fire on water quality at the Santee Experimental Watersheds in South Carolina, 9:50545 (R;US)

WAVE PACKETS
Dispersion Relations
Decay of a packet incident on monocrystal and evolution of a two-particle system and its motion in medium, 9:50950 (RA;SU;In Russian)

WAZ 16
See NICKEL BASE ALLOYS

WEAK INTERACTIONS
Interaction Range
Long-range interaction related to exchange by massless Goldstone particles and methods of its detection, 9:50784 (RA;SU;In Russian)

WEAK NEUTRAL CURRENTS
Superfluid ^{3}He. Neutral currents, T invariance, gravitation, 9:50755 (RA;SU;In Russian)

WEAR
Tracer Techniques
Wear measurements of cutting tools made of hard metal, 9:49573 (R;AT;In German)

WEATHER
Data Compilation
Weather data for simplified energy calculation methods. Volume IV. United States: WYEC data, 9:50022 (R;US)
Weather data for simplified energy calculation methods. Volume II. Middle United States: TRY data, 9:50020 (R;US)
Weather data for simplified energy calculation methods. Volume I. Eastern United States: TRY data, 9:50019 (R;US)
Weather data for simplified energy calculation methods. Volume III. Western United States: TRY data, 9:50021 (R;US)
WECS
See WIND TURBINES
WELDED JOINTS
Ultrasonic Testing
Ultrasonic girth weld evaluation for aluminum substrate of spherical Kevlar-epoxy test specimens, 9:50418 (R;US)
WELDING
See also LASER WELDING
Underwater Operations
Measurement and calculation of the three-dimensional instationary temperature field in underwater welded plates, 9:50112 (R;DE;In German)
WELDS
See WELDED JOINTS
WEST GERMANY
See FEDERAL REPUBLIC OF GERMANY
WESTINGHOUSE NUCLEAR TRAINING REACTOR
See WNTR REACTOR
WET-TYPE COOLING TOWERS
See COOLING TOWERS
WHISKERS
Mechanical Properties
Advanced Research and Technology Development Fossil Energy Materials Program. Quarterly progress report ending June 30, 1984, 9:50094 (R;US)
WIGGLER MAGNETS
Proton Beams
Proton laser accelerator by means of the inverse free electron laser mechanism, 9:50442 (R;US)
WILDERNESS AREAS
See NATURE RESERVES
WIND
Monitoring
Solid-state laser sources for remote sensing, 9:50519 (BA;NL)
WIND ENERGY CONVERSION SYSTEMS
See WIND TURBINES
WIND GENERATORS
See ELECTRIC GENERATORS
WIND TURBINES
WIND POWER
Site Surveys
Wind power parks: 1983 survey, 9:49735 (R;US)
Surveys
Electric utility solar energy activities: 1983 survey, 9:49604 (R;US)
WIND POWER PLANTS
Electric Controllers
Test of windmill control unit from Skjern Elektro Aps and Styrdata, 9:49740 (R;DK;In Danish)
Energy Efficiency
Measurements of 55 kW Nordtank windmill sited at Knebel, Mols. Background report, 9:49741 (R;DK;In Danish)
Measurements of 55 kW Nordtank windmill sited at Knebel, Mols, 9:49742 (R;DK;In Danish)
WIND TURBINES
Computerized Simulation
Modelling of the overall aeroelastic system of a windturbine aided by symbolic programming, 9:49733 (R;DE;In German)
Dynamic Loads
Modelling of the overall aeroelastic system of a windturbine aided by symbolic programming, 9:49733 (R;DE;In German)
Energy Efficiency
Test report for VESTAS windmill, type 15, 55 kW. Standard measurements, 9:49738 (R;DK;In Danish)
Test report for Kramsbjerg windmill 14 kW. Standard measurements, 9:49739 (R;DK;In Danish)
Operation
Wind power parks: 1983 survey, 9:49735 (R;US)
Performance Testing
Test field Pellworm for wind turbines, 9:49736 (R;DE;In German)
Response Functions
Modelling of the overall aeroelastic system of a windturbine aided by symbolic programming, 9:49733 (R;DE;In German)
Test Facilities
Test field Pellworm for wind turbines, 9:49736 (R;DE;In German)
Testing
Test report for VESTAS windmill, type 15, 55 kW. Standard measurements, 9:49738 (R;DK;In Danish)
Test report for Kramsbjerg windmill 14 kW. Standard measurements, 9:49739 (R;DK;In Danish)
Turbine Blades
Thermal stress analysis for a wood composite blade, 9:49737 (R;US)
WINDOWS
Equipment Protection Devices
Purged window apparatus utilizing heated purge gas, 9:49366 (P;US)
Shading
Solar shading of windows: a simple photographic analysis, 9:49688 (R;GB)
WIND-POWERED PUMPS
Wind-mechanical pumps only; for wind-electric pumps use WIND TURBINES and PUMPS.
Energy on an independent farm. Final performance report, 9:49734 (R;US)
WIPP
Pioneering repository development at the Waste Isolation Pilot Plant, 9:49562 (J;GB)
WIRES
See also SUPERCONDUCTING WIRES
Fabrication
Submicron conductor array fabricated from a recrystallized eutectic thin film, 9:50155 (BA;NL)
WNTR REACTOR
Reactor Safety
Safety Evaluation Report related to the renewal of the operating license for the Westinghouse research reactor at Zion, Illinois (Docket No. 50-87), 9:49888 (R;US)
WOLFRAM
See TUNGSTEN
WOOD
Combustion Kinetics
Oxidation of volatiles in residential wood burning equipment. Final technical report, September 1980-February 1984, 9:49589 (R;US)
Gasification
Catalysts for gasification of biomass, 9:49586 (R;US)
Gasification of biomass for the production of methanol and ammonia, 9:49587 (R;US)
Radiation Curing
Radiation-curable impregnating agents for the conservation of archaelogic wooden objects (Gamma radiation), 9:50347 (R;AT;In German)
Radiation-curable impregnating agents for the conservation of archaeologic wooden objects. Part 2 (Gamma radiation), 9:50348 (R;AT;In German)
WOOD BURNING APPLIANCES
Commercialization
Biomass wood. Final technical report, 9:49981 (R;US)
Performance Testing
Biomass wood. Final technical report, 9:49981 (R;US)
WOOD FUELS
Use of this term is limited to polcy, feasibility, and socio-economic studies. For wood properties use WOOD.
District Heating
Economic evaluation of a district heating plant in Trysil (Norway), 9:49925 (R;NO;In Norwegian)
Prices
Economic evaluation of a district heating plant in Trysil (Norway), 9:49925 (R;NO;In Norwegian)

WOOD-FUEL POWER PLANTS
Meetings
Proceedings: EPRI/TVA biomass workshop on the use of biomass for the generation of electric power, 9:49590 (R;US)
WORKERS
See PERSONNEL
WORKING CONDITIONS
Monitoring
Instrumentation for occupational health research, 9:50494 (R;US)
WORKING FLUIDS
See also REFRIGERANTS
Phase Change Materials
Improvement of the performance of solar energy or waste heat utilization systems by using phase-change slurry as an enhanced heat-transfer/storage fluid, 9:49710 (BA;US)
WOUNDS
Radioinduction
Plutonium-induced wounds in beagles, 9:50621 (J;GB)
WWER TYPE REACTORS
Computer Codes
Physical and mathematical models and computer codes for global reactor calculations of WWER, 9:49775 (RA;BG;In Bulgarian)
Control Elements
Position measurement of reactor control rods in start-up experiments, 9:49824 (RA;CS;In Czech)
Control Rod Drives
Control and testing unit for linear stepping drive of WWER 1000 reactor regulating rod, 9:49819 (RA;CS;In Czech)
Energy Yield
Fixed in-core detector reading analysis, 9:49776 (RA;BG;In Bulgarian)
Fuel Rods
Performance analysis of VVER-type fuel rods with the STOFFEL-1 computer code, 9:49778 (R;DD)
Functional Models
Physical and mathematical models and computer codes for global reactor calculations of WWER, 9:49775 (RA;BG;In Bulgarian)
Mathematical Models
Physical and mathematical models and computer codes for global reactor calculations of WWER, 9:49775 (RA;BG;In Bulgarian)
Pressure Vessels
Control and evaluation part of equipment for testing WWER 440 pressure vessels, 9:49773 (RA;CS;In Czech)
Primary Coolant Circuits
Reliability analysis of selected systems of nuclear power unit, 9:49774 (RA;CS;In Czech)
Simulation of the dynamic behaviour of the primary circuit in a WWER-440 type nuclear power plant Pt. 1, 9:49777 (R;HU)
Reactor Control Systems
Computer-aided core surveillance: a conceptual study for WWER type reactors, 9:49825 (RA;BG;In Bulgarian)
Hybrid model of reactor neutron power control, 9:49820 (RA;CS;In Czech)
Reactor Kinetics
Hybrid model of reactor neutron power control, 9:49820 (RA;CS;In Czech)
Reactor Operation
Analysis of selected operating modes in WWER 440 nuclear power plants, 9:49823 (RA;CS;In Czech)
Secondary Coolant Circuits
Reliability analysis of selected systems of nuclear power unit, 9:49774 (RA;CS;In Czech)
Steam Turbines
Analysis of selected operating modes in WWER 440 nuclear power plants, 9:49823 (RA;CS;In Czech)

X

XENON
Excitation
Multiphoton ionization photoelectron spectroscopy: xenon and nitric oxide, 9:50340 (J;NL)
XENON 132 TARGET
Proton Reactions
Description of fragmentation as a critical phenomenon in high energy p-nucleus collisions, 9:50868 (J;NL)
X-RASERS
See X-RAY LASERS
X-RAY EQUIPMENT
Radiation Protection
Laboratory techniques for safe encapsulation of α-emitting powder samples, 9:50363 (R;GB)
X-RAY FLUORESCENCE ANALYSIS
Probes
X-ray microprobe characterization of materials: the case for undulators on advanced storage rings, 9:50260 (R;US)
X-RAY LASERS
Implosions
Imploding plasma x-ray laser research. Draft final report, 9:50394 (R;US)
X-RAY SPECTRA
Fine Structure
Extended x-ray absorption fine structure in photoelectron emission, 9:50304 (J;US)
X-RAY SPECTROMETERS
Application of layered synthetic microstructures to high-temperature plasma diagnostics, 9:50498 (R;US)
Computerized Simulation
Simulation of bent crystal spectrometers, 9:50499 (R;US)
Crystals
Simulation of bent crystal spectrometers, 9:50499 (R;US)
X-RAY SPECTROSCOPY
Spectra Unfolding
Monte Carlo error analysis in x-ray spectral deconvolution, 9:50481 (R;US)

Y

YANG-MILLS THEORY
Analytical Solution
Some self-dual SO(3) solutions of the Yang-Mills equation and a note on harmonic maps, 9:50816 (D;US)
YIELD (FISSION)
See FISSION YIELD
YOSHIDA SARCOMA
See EXPERIMENTAL NEOPLASMS
YTTERBIUM 165
Heavy Ion Reactions
Neutron evaporation following heavy ion reactions for systems with $150 < A < 190$, 9:50883 (RA;AU)
Rotational States
Properties of quasi neutron configurations in 165FYb at very large angular frequencies. Interpretation in terms of gradual neutron pairing decrease, 9:50896 (BA;JP)
YTTERBIUM 168
Heavy Ion Reactions
Heavy ion induced fission reactions, 9:50891 (RA;AU)
YTTRIUM 89 TARGET
Niobium 93 Reactions
Studies of extremely neutron-deficient isotopes near the proton shell Z = 82, 9:50882 (R;DE;In German)
YTTRIUM ALLOYS
Chemical Composition
Isothermal equilibrium pressures of a Y-Nb alloy-H_2 system, 9:50310 (J;CH)
YTTRIUM ALUMINIUM GARNETS
See ALUMINIUM OXIDES

YUCCA MOUNTAIN
Geology
Geohydrologic data for test well UE-25p No. 1, Yucca Mountain area, Nye County, Nevada, 9:49561 (R;US)
Hydrology
Geohydrologic data for test well UE-25p No. 1, Yucca Mountain area, Nye County, Nevada, 9:49561 (R;US)

Z

ZEOLITES
See also MORDENITE
Catalytic Effects
Metal-zeolite catalysts for the conversion of synthesis gas to selected hydrocarbon products, 9:49582 (BA;US)
ZINC
Absorption Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Activation Analysis
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Emission Spectroscopy
Selection of the best elemental variables for the classification of glass samples, 9:50294 (J;CH)
Proton Microprobe Analysis
Elemental microanalysis of individual blood cells, 9:50277 (RA;AU)
Soil Chemistry
Attenuation of chemical elements in acidic leachates from coal mineral wastes by soils, 9:49407 (R;US)
X-Ray Fluorescence Analysis
On-stream determination of Zn-content in Zn-ore slurries by radioisotope excited X-ray fluorescence, 9:50291 (R;AT)
ZINC COMPLEXES
Photochemical Reactions
Polyelectrolytes as interfaces for retarding back-reaction in photoinduced electron transfer, 9:50335 (R;US)
ZINC ORES
Multi-Element Analysis
On-stream determination of Zn-content in Zn-ore slurries by radioisotope excited X-ray fluorescence, 9:50291 (R;AT)
ZINC OXIDES
Sorptive Properties
Metal/metal oxides as high temperature desulfurization sorbents, 9:49338 (RA;US)
ZINC SULFATES
Decomposition
Solar heated rotary kiln, 9:49697 (P;US)
ZION STATION UNIT-1
See ZION-1 REACTOR
ZION-1 REACTOR
Zion, Illinois, USA
Reactor Accidents
Categorization of PWR accident sequences and guidelines for fault trees: seismic initiators, 9:49901 (R;US)
ZIRCALOY 4
Chemical Reactions
Chemical interactions between UO_2 and zircaloy-4 from 1000 to 2000°C, 9:49867 (RA;DE;In German)
Fuel-Cladding Interactions
Chemical interactions between UO_2 and zircaloy-4 from 1000 to 2000°C, 9:49867 (RA;DE;In German)
ZIRCONIUM 90 TARGET
Niobium 93 Reactions
Studies of extremely neutron-deficient isotopes near the proton shell Z = 82, 9:50882 (R;DE;In German)
Oxygen 16 Reactions
Heavy ion excitation and photon decay of giant resonances, 9:50880 (J;FR)
Pion Minus Reactions
Dependence of the excitation energy, width, and cross section of the isovector monopole resonance, 9:50878 (J;FR)
Pion Plus Reactions
Dependence of the excitation energy, width, and cross section of the isovector monopole resonance, 9:50878 (J;FR)
Pion Reactions
Excitation of giant resonances in pion charge-exchange reactions, 9:50879 (J;FR)
ZIRCONIUM ALLOYS
Thermodynamic Properties
Thermodynamic properties of gamma-uranium in the formation of solid solutions with alpha-transition metals, 9:50150 (TG;US)
ZIRCONIUM BORIDES
Thermionic Emission
Thermionic emission and vaporization behavior of the ternary systems of lanthanum hexaboride containing molybdenum boride, molybdenum diboride, zirconium diboride, gadolinium hexaboride, and neodymium hexaboride, 9:50168 (J;US)
ZIRCONIUM COMPLEXES
Structural Chemical Analysis
Trigonal-bipyramidal methyl group bridging two zirconocene-ketene centers, 9:50307 (J;US)
ZIRCONIUM HYDRIDES
Physical Properties
Properties and thermal stabilities of amorphous transition metal hydrides (Zr_2PdH_x; Zr_3RhH_x), 9:50163 (R;US)

CONTRACT NUMBER INDEX

Numbers assigned to DOE contracts under which documents announced in this publication were prepared are included in this index.

Contract No.	*Abstract No.*	*Report No.*
AC01-78CS40091	**University City Science Center, Philadelphia, PA (USA)**	
	9:49971	DOE/CS/40091—T3
	9:49972	DOE/CS/40091—T4
	9:49973	DOE/CS/40091—T6
	9:49974	DOE/CS/40091—T7
	9:49975	DOE/CS/40091—T8
	9:49976	DOE/CS/40091—T9
	9:49977	DOE/CS/40091—T10
	9:49978	DOE/CS/40091—T11
	9:49979	DOE/CS/40091—T12
	9:50035	DOE/CS/40091—T5
AC01-78CS54237	**Mathtech, Inc., Princeton, NJ (USA)**	
	9:49961	DOE/CS/54237—T1
AC01-78ET10425	**Mitre Corp., McLean, VA (USA). METREK Div.**	
	9:49749	MTR—80W76-03
AC01-78ET26946	**National Materials Advisory Board (NRC), Washington, DC (USA)**	
	9:49913	NMAB—390
AC01-79CS30012	**DHR, Inc., Washington, DC (USA)**	
	9:49684	DOE/CS/30012—T1
AC01-79CS30027	**Vitro Corp., Silver Spring, MD (USA)**	
	9:49691	SOLAR/0011—84/01
	9:49692	SOLAR/0013—84/30
	Vitro Labs., Silver Spring, MD (USA)	
	9:49693	SOLAR/0015—84/32
	9:49694	SOLAR/0802—84/01
	Automated Industries, Inc., Silver Spring, MD (USA)	
	9:49695	SOLAR/1024—79/10
AC01-79ET29366	**Scientific Systems, Inc., Cambridge, MA (USA)**	
	9:49743	DOE/ET/29366—1
AC01-79PE70025	**TRANSCOMM, Inc., Falls Church, VA (USA)**	
	9:49934	DOE/PE/70025—T1
AC01-80PE70267	**Resources for the Future, Inc., Washington, DC (USA)**	
	9:49457	DOE/PE/70267—T4
	9:49458	DOE/PE/70267—T6
	9:49459	DOE/PE/70267—T7
	9:49460	DOE/PE/70267—T8
	9:49479	DOE/PE/70267—T5
AC01-81EV10472	**Rogers, Golden and Halpern, Inc., Philadelphia, PA (USA)**	
	9:49442	DOE/EV/10472—T7
	9:49456	DOE/EV/10472—T6
	9:49467	DOE/EV/10472—T2
	Rogers, Golden and Halpern, Inc., Reston, VA (USA)	
	9:49468	DOE/EV/10472—T3
	Rogers, Golden and Halpern, Inc., Philadelphia, PA (USA)	
	9:49469	DOE/EV/10472—T5
	ERT, Concord, MA (USA)	
	9:49927	DOE/EV/10472—T4
AC02-76CH00016	**Brookhaven National Lab., Upton, NY (USA)**	
	9:49892	NUREG/CR—3765
	9:49893	NUREG/CR—3813
	9:49942	BNL—35178
	9:49966	Journal of the Electrochemical Society 131 1215-1216 (May 1984).
AC02-76CH00016	**Department of Physics and Astronomy, Northwestern University, Evanston, Illinois 60201 and Fundament**	
	9:50142	Physical Review [Section] B: Condensed Matter 30 NO. 1. 36-43 (1 Jul 1984).
AC02-76CH00016	**Brookhaven National Lab., Upton, NY (USA)**	
	9:50172	BNL—34086
	9:50337	Journal of the American Chemical Society 106 NO. 14. 3950-3958 (11 Jul 1984).
AC02-76CH00016	**Army Research and Development Command, Dover, NJ (USA)**	
	9:50365	BNL—35171
	Brookhaven National Lab., Upton, NY (USA)	
	9:50442	BNL—35084
	9:50457	BNL—35133
	Stichting Energieonderzoek Centrum Nederland, Petten. Energie Studie Centrum	
	9:50520	BNL—35207
	Brookhaven National Lab., Upton, NY (USA)	
	9:50521	BNL—51542
	9:50566	BNL—35124
	9:50602	BNL—35250
	9:50629	BNL—51783
	9:50647	Studies in Environmental Science 20 175-184 (1982).
	9:50819	BNL—51778
	9:50941	BNL—35226
AC02-76CH03000	**Fermi National Accelerator Lab., Batavia, IL (USA)**	
	9:50445	FNAL/C—84/73-T
AC02-76ER01198	**Monash Univ., Clayton, Victoria, Australia**	
	9:50145	Metallurgical Transactions, [Section] A: Physical Metallurgy and Materials Science 15A 108
AC02-76ER01198	**Univ. of Illinois at Urbana-Champaign**	
	9:50151	Solid State Communications 47 NO. 11. 935-938 (1983).
	9:50207	Review of Scientific Instruments 55 NO. 10. 1620-1624 (Oct 1984).
AC02-76ER01338	**Michigan State Univ., East Lansing**	
	9:50588	HortScience 15 NO. 5. 623-629 (Oct 1980).
AC02-76ER01674	**Chicago Univ., IL (USA)**	
	9:50727	DOE/ER/01674—T1
AC02-76ER02220	**The Institute for Advanced Study, Princeton, New Jersey 08540**	
	9:50810	Physical Review [Section] D: Particles and Fields 30 NO. 4. 809-818 (15 Aug 1984).
AC02-76ER02296	**Univ. of Rochester, NY**	
	9:50254	Philosophical Magazine, [Part] A: Defects and Mechanical Properties 46 NO. 2. 211-215 (198

Contract No.	Abstract No.	Report No.
AC02-76ER03069	**Center for Theoretical Physics, Laboratory for Nuclear Science and Department of Physics, Massachuse**	
	9:50798	Physical Review [Section] D: Particles and Fields 29 NO. 12. 2975-2976 (15 Jun 1984).
AC02-76ER03069	**Center for Theoretical Physics, Laboratory for Nuclear Science and Department of Physics, Massachuse**	
	9:50811	Physical Review [Section] D: Particles and Fields 29 NO. 12. 2769-2772 (15 Jun 1984).
AC02-76ER03077	**New York Univ., NY (USA). Courant Mathematics and Computing Lab.**	
	9:50398	DOE/ER/03077—223
AC02-76ET53003	**Michigan Univ., Ann Arbor (USA). Dept. of Nuclear Engineering**	
	9:51003	DOE/ET/53003—2
	9:51004	DOE/ET/53003—3
AC02-76EV03490	**Univ. of Rochester School of Medicine and Denistry, NY**	
	9:50619	Health Physics 47 NO. 1. 47-57 (Jul 1984).
AC02-77CH00178	**Consumer Energy Council of America, Washington, DC**	
	9:49603	DOE/CH/00178—T23
AC02-77EV04321	**Rochester Univ., NY (USA). Dept. of Chemistry**	
	9:50318	DOE/EV/04321—T2
	9:50714	DOE/EV/04321—4
AC02-77EV04331	**Pennsylvania State Univ., University Park**	
	9:50639	Journal of the Air Pollution Control Association 34 NO. 6. 668-669 (Jun 1984).
AC02-77EV04368	**Cornell Univ., Ithaca, NY**	
	9:50649	Phytopathology 71 NO. 4. 445-448 (1981).
AC02-78EV04733	**Columbia Univ., New York, NY**	
	9:50617	International Journal of Radiation Oncology, Biology and Physics 10 NO. 8. 1407-1410 (Aug
AC02-79ER10364	**School of Physics and Astronomy, University of Minnesota, Minneapolis, Minnesota 55455**	
	9:50707	Physical Review [Section] D: Particles and Fields 30 NO. 4. 831-832 (15 Aug 1984).
AC02-79ER10429	**Pennsylvania Univ., Philadelphia (USA). Dept. of Materials Science and Engineering**	
	9:50108	DOE/ER/10429—T3
AC02-79ET34014	**Westinghouse Electric Corp., Pittsburgh, PA (USA). Nuclear Energy Systems Div.**	
	9:49770	DOE/ET/34014—16
AC02-79ET34015	**Commonwealth Research Corp., Chicago, IL (USA)**	
	9:49771	DOE/ET/34015—8
AC02-80ER10619	**Virginia Polytechnic Inst. and State Univ., Blacksburg, VA**	
	9:50167	Journal of the American Ceramic Society C.85-C.86 (May 1984).
AC02-80ER10689	**Purdue Univ., West Lafayette, IN**	
	9:50322	Journal of the American Chemical Society 106 NO. 14. 3891-3899 (11 Jul 1984).
AC02-80ER10689	**Purdue Univ., West Lafayette, IN**	
	9:50323	Journal of the American Chemical Society 106 NO. 14. 3900-3904 (11 Jul 1984).
AC02-80EV10380	**Univ. of Cincinnati, OH**	
	9:50354	Inorganic Chemistry 23 NO. 18. 2898-2901 (29 Aug 1984).
AC02-80RA50156	**Cable Technology Labs., Inc., New Brunswick, NJ (USA)**	
	9:49759	DOE/RA/50156—5
AC02-81ER10908	**Stevens Institute of Technology, Hoboken, New Jersey 07030**	
	9:50304	Physical Review Letters 53 NO. 12. 1183-1186 (17 Sep 1984).
AC02-81ER10922	**Wisconsin Univ., Madison (USA). Dept. of Chemical Engineering**	
	9:50175	DOE/ER/10922—T1
AC02-81ER40007	**Indiana Univ., Bloomington (USA)**	
	9:50821	DOE/ER/40007—26
AC02-82ER13004	**Colorado Univ., Boulder (USA)**	
	9:50317	DOE/ER/13004—2
AC02-82ER40051	**School of Physics and Astronomy, University of Minnesota, Minneapolis, Minnesota 55455**	
	9:50789	Physical Review [Section] D: Particles and Fields 30 NO. 1. 118-122 (1 Jul 1984).
AC02-83CH10093	**Naval Research Lab., Washington, DC (USA)**	
	9:49627	SERI/STR—211-2393
	9:49628	Applied Physics Letters 45 NO. 7. 746-748 (1 Oct 1984).
	9:49629	Applied Physics Letters 45 NO. 6. 668-670 (15 Sep 1984).
	Solar Energy Research Inst., Golden, CO (USA)	
	9:49690	SERI/SP—253-2373
AC02-83CH10140	**Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation**	
	9:49539	BMI/ONWI—545
	Texas A and M Univ., College Station (USA). Research Foundation	
	9:50665	BMI/ONWI—550
AC02-83ER13126	**Case Western Reserve Univ., Cleveland, OH (USA)**	
	9:50176	DOE/ER/13126—T1
AC02-83ER40118	**Department of Physics and College of Engineering, Boston University, Boston, Massachusetts 02215**	
	9:50812	Physical Review [Section] D: Particles and Fields 29 NO. 12. 2977-2978 (15 Jun 1984).
AC02-83ER60142	**Columbia Univ., New York, NY**	
	9:50616	International Journal of Radiation Oncology, Biology and Physics 10 NO. 8. 1255-1259 (Aug
AC03-76SF00098	**California Univ., Berkeley (USA)**	
	9:49387	DOE/METC—84-5
	Lawrence Berkeley Lab., CA (USA)	
	9:49477	LBL—16518
	9:49908	LBL-PUB—3044
	9:49994	LBL—17364
	9:49995	LBL—17967
	9:49996	LBL—17994
	9:49997	LBL—18114
	9:50092	LBL—18027
	9:50133	LBL—18292
	9:50141	Applied Physics Letters 45 NO. 7. 792-794 (1 Oct 1984).
	9:50162	LBL—17954
	9:50203	LBL—18276
	9:50301	LBL—18183
	9:50302	LBL—18297
	9:50321	Journal of the American Chemical Society 106 NO. 15. 4108-4111 (25 Jul 1984).
AC03-76SF00098	**Lawrence Berkeley Lab., CA (USA)**	
	9:50335	LBL—18290
	9:50372	LBL—18195
	9:50373	LBL—18362
	9:50383	Applied Physics Letters 45 NO. 7. 799-801 (1 Oct 1984).
	9:50482	LBL—18259
	9:50594	LBL—16840

Contract No.	Abstract No.	Report No.
	9:50618	International Journal of Radiation Oncology, Biology and Physics 10 NO. 8. 1203-1205 (Aug
AC03-76SF00098	Lawrence Berkeley Lab., CA (USA)	
	9:50675	LBL—18271
	9:50743	LBL—17827
	9:50744	LBL—18011
	9:50745	LBL—18080
	9:50746	LBL—18216
	9:50747	LBL—18275
	9:50756	LBL—18217
	9:50799	Physics Reports: A Review Section of Physics Letters (Section C) 104 NO. 2-4. 113-128 (Fe
AC03-76SF00098	South Carolina Univ., Columbia (USA)	
	9:50867	LBL—18316
	Oak Ridge Associated Universities, Inc., TN (USA)	
	9:50905	LA-UR—84-3022
	9:50919	Nuovo Cimento [Sezione] A 81 NO. 1. 21-36 (1 May 1984).
	9:50921	Nuclear Physics [Section] A 418 59c-85c (23 Apr 1984).
	Lawrence Berkeley Lab., CA (USA)	
	9:50955	LBL—18193
	9:51056	LBL—18246
	9:51057	LBL-PUB—3045
AC03-76SF00515	Stanford Linear Accelerator Center, CA (USA)	
	9:50140	SLAC-PUB—3378
	9:50453	SLAC-CN—280
	9:50454	SLAC-PUB—3427
	9:50464	SLAC-PUB—3396
	9:50708	Physical Review [Section] D: Particles and Fields 29 NO. 12. 2791-2797 (15 Jun 1984).
AC03-76SF00515	Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305	
	9:50809	Physical Review [Section] D: Particles and Fields 30 NO. 4. 797-808 (15 Aug 1984).
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AC04-76DP00053	Monsanto Research Corp., Miamisburg, OH (USA). Mound	
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AC04-76DP00487	Mason and Hanger-Silas Mason Co., Inc., Amarillo, TX (USA)	
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AC04-76DP00789	Sandia National Labs., Albuquerque, NM (USA)	
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AC05-78OR03054	Jenike and Johanson, Inc., North Billerica, MA (USA)	
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AC05-81OR20722	Bechtel National, Inc., Oak Ridge, TN (USA)	
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AC05-84OR21400	Oak Ridge National Lab., TN (USA)	
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	9:49605	CONF-8310316—1
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	Kando (Paul F.), Inc., Washington, DC (USA)	
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	Varian Associates, Inc., Palo Alto, CA (USA)	
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	Oak Ridge National Lab., TN (USA)	
	9:51050	CONF-8409147—1
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AC05-84OS21400	**Oak Ridge Y-12 Plant, TN (USA)**	
	9:50416	Y/DW—474
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AC05-84OT21400	**Paducah Gaseous Diffusion Plant, KY (USA)**	
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AC06-76FF02170	**Hanford Engineering Development Lab., Richland, WA (USA)**	
	9:50367	HEDL—7376-Rev.1
AC06-76RL01830	**Pacific Northwest Lab., Richland, WA (USA)**	
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	9:49554	PNL—4937
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AC06-77RL01030	**Battelle Human Affairs Research Center, Seattle, WA (USA)**	
	9:49558	RHO-BW-CR—142-P
AC07-76GJ01664	**Stieff Research and Development Co., Inc., Kensington, MD (USA)**	
	9:49568	GJ/TMC—15
AC07-76ID01570	**EG and G/Washington Analytical Services Center, Inc., Morgantown, WV (USA)**	
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	EG and G Idaho, Inc., Idaho Falls (USA)	
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Contract No.	Abstract No.	Report No.
	Arizona State Univ., Tempe (USA)	
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	EG and G Idaho, Inc., Idaho Falls (USA)	
	9:49592	EGG—2330
	9:49854	EGG-M—08484
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AC09-76SR00001	**Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.**	
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AC18-80FC10184	**Univ. of Cincinnati, OH**	
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AC19-80BC10033	**Keplinger and Associates, Inc., Tulsa, OK (USA)**	
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AC21-77ET10373	**USDOE Morgantown Energy Technology Center, WV**	
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AC21-79ET14812	**Air Pollution Tech., Inc., San Diego, CA**	
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AC21-80ET15492	**Air Pollution Technology, Inc., San Diego, CA (USA)**	
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AC21-81MC16021	**USDOE Morgantown Energy Technology Center, WV**	
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AC21-81MC16551	**New Mexico State Univ., Las Cruces (USA). Dept. of Chemical Engineering**	
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AC21-83FE60338	**United Technologies Corp., South Windsor, CT (USA). Power Systems Div.**	
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AC21-83MC20013	**Holder (Gerald), Morgantown, WV (USA)**	
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AC21-83MC20693	**Colorado School of Mines, Golden (USA). Dept. of Chemical and Petroleum Refining Engineering**	
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AC22-76ET10154	**Catalytic, Inc., Wilsonville, AL (USA)**	
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AC22-81PC40784	**Pennsylvania State Univ., University Park (USA)**	
	9:49352	DOE/PC/40784—T4
AC22-82PC50001	**Gulf Research and Development Co., Shawnee Mission, KS (USA)**	
	9:49354	DOE/PC/50001—23
AC22-83PC60044	**Auburn Univ., AL (USA). Coal Conversion Lab.**	
	9:49355	DOE/PC/60044—T2
	Auburn Univ., AL (USA). Dept. of Chemical Engineering	
	9:50299	DOE/PC/60044—T1
AC22-83PC60047	**Cities Service Research and Development Co., Tulsa, OK (USA)**	
	9:49356	DOE/PC/60047—T4
AC22-83PC60265	**Science Applications, Inc., San Diego, CA (USA)**	
	9:49400	SAIC—84/1782
AC22-84PC72007	**Amax Extractive R and D, Inc., Golden, CO (USA)**	
	9:49383	DOE/PC/72007—2
AC79-79BP13222	**Allen (Eliot) and Associates, Inc., Salem, OR (USA)**	
	9:49601	DOE/BP—287

Contract No.	Abstract No.	Report No.
AC79-83BP11279	Seton, Johnson, and Odell, Inc., Portland, OR (USA)	
	9:50582	DOE/BP—280
AI01-76ET20356	Jet Propulsion Lab., Pasadena, CA (USA)	
	9:49602	DOE/ET/20356—15
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AI01-78CS55138	Metropolitan Washington Council of Governments, DC (USA)	
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	Northern Middlesex Area Commission, Lowell, MA (USA)	
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AI08-78ET44802	Geological Survey, Lakewood, CO (USA)	
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AI21-80ET17088	Cleveland State Univ., OH (USA)	
	9:49965	DOE/NASA—0017-2
AM01-76EI02295	Massachusetts Inst. of Tech., Cambridge (USA)	
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AM01-78RG03365	Kearney (A.T.), Inc., Alexandria, VA (USA)	
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AM03-76SF00115	Stanford Univ., CA (USA). Stanford Synchrotron Radiation Lab.	
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	SRI International, Menlo Park, CA (USA)	
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AM04-80AL13137	Jet Propulsion Lab., Pasadena, CA (USA)	
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AS01-76ET10577	Pittsburgh Univ., PA (USA). Dept. of Metallurgical and Materials Engineering	
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AS01-77ET25003	Massachusetts Inst. of Tech., Cambridge (USA)	
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AS05-76ER03346	Georgia Inst. of Tech., Atlanta (USA). School of Chemistry	
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AS05-76ER03509	Florida State Univ., Tallahassee (USA). Dept. of Physics	
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AS05-76ER03624	Duke Univ., Durham, NC (USA)	
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AS05-76ER03992	Center for Particle Theory, The University of Texas at Austin, Austin, Texas 78712	
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AS05-76EV03861	Tennessee Univ., Knoxville (USA). Dept. of Physics and Astronomy	
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AS05-78EV10133	Univ. of Miami, Coral Gables, FL	
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AS05-80ER10578	Texas A and M Univ., College Station (USA). Dept. of Physics	
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AS05-80ER10618	Vanderbilt Univ., Nashville, TN (USA). Dept. of Computer Science	
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AS05-80ER10713	Department of Physics, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 240	
	9:50813	Physical Review [Section] D: Particles and Fields 29 NO. 12. 2989-2992 (15 Jun 1984).
AS05-81ER10946	Houston Univ., TX (USA). Dept. of Chemical Engineering	
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	Martin Marietta Labs., Baltimore, MD (USA)	
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AS05-81ER10959	Department of Physics, University of Virginia, Charlottesville, Virginia 22901	
	9:50212	Physical Review [Section] B: Condensed Matter 29 NO. 12. 6525-6529 (15 Jun 1984).
AS05-81ER40008	Florida Univ., Gainesville (USA). Dept. of Physics	
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AS08-83DP40183	Wisconsin Univ., Madison (USA). Dept. of Nuclear Engineering	
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AS08-83NV10354	Texas Southern Univ., Houston (USA). Dept. of Chemistry	
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AS19-80BC10321	University of Southern Mississippi, Hattiesburg (USA). Dept. of Polymer Science	
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AT02-80CH92122	Battelle Columbus Labs., OH (USA)	
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AT03-76ER70262	California Univ., Santa Barbara (USA). Dept. of Chemistry	
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AT03-76ER72018	Stanford Univ., CA (USA). Systems Optimization Lab.	
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AT03-76ER75016	California Inst. of Tech., Pasadena (USA). Dept. of Chemical Engineering	
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AT03-79EV10252	California Univ., Santa Barbara (USA). Marine Science Inst.	
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AT03-80ER10617	California Univ., Berkeley (USA)	
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AT03-82ER12099	Hawaii Univ., Honolulu (USA)	
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AT03-83ER60169	Radiation Effects Research Foundation, Hiroshima (Japan)	
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AT03-84ER13164	California Univ., Santa Barbara (USA). Dept. of Mechanical and Environmental Engineering	
	9:50399	DOE/ER/13164—T1
AT06-81ER10939	Department of Electrical and Computer Engineering, Oregon State University, Corvallis, Oregon 97331	
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AT21-77MC08707	West Virginia Univ., Morgantown (USA). Dept. of Chemical Engineering	
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EM-78-C-01-5313	Urban Systems Research and Engineering, Inc., Cambridge, MA (USA)	
	9:50065	DOE/NBM—4016871
FC01-83CE40654	University City Science Center, Philadelphia, PA (USA)	
	9:49970	DOE/CE/40654—T2
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FC01-83FE60149	National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)	
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	9:49685	DOE/ET/20643—T4

Contract No.	Abstract No.	Report No.
FC03-77SF10501	**Southern California Edison Co., Rosemead (USA)**	
	9:49667	DOE/SF/10501—017
	9:49668	DOE/SF/10501—019
	9:49669	DOE/SF/10501—059
	General Electric Co., El Monte, CA (USA)	
	9:49670	DOE/SF/10501—060
	Southern California Edison Co., Rosemead (USA)	
	9:49671	DOE/SF/10501—063
	9:49678	DOE/SF/10501—004
	9:49912	DOE/SF/10501—014
FC21-83FE60177	**Western Research Inst., Laramie, WY (USA)**	
	9:49496	DOE/FE/60177—1664
FC21-83FE60181	**North Dakota Univ., Grand Forks (USA). Energy Research Center**	
	9:49377	DOE/FE/60181—64
	9:49378	DOE/FE/60181—1642
FG01-80ET13617	**Engineering Foundation, New York (USA)**	
	9:49426	DOE/ET/13617—T1
FG01-81CA10004	**Greenhills Foundation, Dallas, TX (USA)**	
	9:49578	DOE/CA/10004—T1
FG02-79ER10540	**North Carolina State Univ., Raleigh**	
	9:50305	Inorganic Chemistry 23 NO. 18. 2874-2878 (29 Aug 1984).
FG02-80CE30760	**Washington Univ., Seattle (USA)**	
	9:49589	DOE/CE/30760—T1
FG05-80ET53088	**Texas Univ., Austin (USA). Inst. for Fusion Studies**	
	9:51005	DOE/ET/53088—154-Pt.A
	9:51006	DOE/ET/53088—154-Pt.B
FG05-84ER60212	**North Carolina Univ., Chapel Hill (USA). Dept. of Environmental Sciences and Engineering**	
	9:50631	CONF-8404193—Abstr.
FG07-83ID12434	**Southern States Energy Board, Atlanta, GA (USA)**	
	9:49545	DOE/LLW—32T
	9:49546	DOE/LLW—33T
	9:49547	DOE/LLW—34T
FG22-81PC40810	**North Dakota Univ., Grand Forks (USA)**	
	9:49353	DOE/PC/40810—10
FG22-82PC50797	**California Univ., Riverside (USA). Dept. of Chemistry**	
	9:49382	DOE/PC/50797—T7
FG44-80R410161	**Dana (Tom and Caleb), Lumberton, MS (USA)**	
	9:49734	DOE/R4/10161—T1
FG44-80R410233	**Simpson (B.J.), Coker, AL (USA)**	
	9:49595	DOE/R4/10233—T1
FG44-80R410320	**Center for Human Development, Jackson, MS (USA)**	
	9:50066	DOE/R4/10320—T1
FG44-81R410484	**Elliott (Aubrey H.), Nichols, SC (USA)**	
	9:49981	DOE/R4/10484—T1
FG44-81R410487	**Mississippi Univ., University (USA)**	
	9:49704	DOE/R4/10487—T1
FG44-81R410499	**Center for Human Development, Jackson, MS (USA)**	
	9:49982	DOE/R4/10499—T1
FG45-80CS69095	**Illinois Dept. of Energy and Natural Resources, Springfield (USA). Div. of Energy and Environmental Affairs**	
	9:49959	DOE/CS/69095—3
NAS-7-100-955392	**Underwriters Labs., Inc., Northbrook, IL (USA)**	
	9:49608	DOE/JPL/955392—3
NAS-7-100-956312	**Mobil Solar Energy Corp., Waltham, MA (USA)**	
	9:50187	DOE/JPL/956312—08
NAS-7-100-956615	**Westinghouse Research and Development Center, Pittsburgh, PA (USA)**	
	9:49609	DOE/JPL/956615—84/3
NAS-7-100-956786	**Westinghouse Research and Development Center, Pittsburgh, PA (USA)**	
	9:49610	DOE/JPL/956786—84/1

Contract No.	Abstract No.	Report No.
W-31-109-ENG-38	**Argonne National Lab., IL (USA)**	
	9:49329	ANL/FE—83-23
	9:49376	CONF-8408106—1
	Illinois State Univ., Normal (USA)	
	9:49683	CONF-840954—6
	Argonne National Lab., Idaho Falls, ID (USA)	
	9:49782	CONF-840901—15
	Argonne National Lab., IL (USA)	
	9:49834	DOE/NBM—5001189
	9:49849	CONF-840901—16
	9:49850	CONF-841122—1
	9:49851	CONF-841174—1
	Wisconsin Univ., Milwaukee (USA). Dept. of Mechanical Engineering	
	9:49852	CONF-841174—4
	Argonne National Lab., IL (USA)	
	9:50062	ANL/EES-TM—251
	9:50101	CONF-841157—4
	9:50105	CONF-8409130—5
	9:50171	ANL-Trans—517(Sep 1967).
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	9:50297	CONF-840807—5
	9:50306	Journal of the American Chemical Society 106 NO. 15. 4167-4172 (25 Jul 1984).
W-31-109-ENG-38	**Argonne National Lab., IL**	
	9:50315	Solid State Communications 44 NO. 8. 1195-1198 (1982).
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	Argonne National Lab., Idaho Falls, ID (USA)	
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	Michigan Univ., Ann Arbor (USA)	
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	9:50449	Nuovo Cimento [Sezione] A 81 NO. 1. 191-200 (1 May 1984).
	Argonne National Lab., IL (USA)	
	9:50456	ANL/PHY—84-2
	9:50458	CONF-840790—3
	9:50459	CONF-8405113—4
	9:50460	CONF-8409150—1
	9:50549	CONF-8410148—1
	9:50556	CONF-8410147—1
	Corps of Engineers, Rock Island, IL (USA)	
	9:50567	CONF-841198—1
	Argonne National Lab., IL (USA)	
	9:50608	CONF-8410147—2
	9:50632	CONF-8405207—3
	Maryland Univ., Catonsville (USA). Dept. of Chemistry	
	9:50633	CONF-8408105—1
	Argonne National Lab., IL (USA)	
	9:51030	CONF-840937—5
	9:51031	CONF-840937—6
	9:51048	ANL—84-63
	9:51049	ANL/TM—404-Rev.
W-7405-ENG-26	**Synergic Resources Corp., Bala-Cynwyd, PA (USA)**	
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W-7405-ENG-26	**Oak Ridge National Lab., TN**	
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W-7405-ENG-36	**Los Alamos National Lab., NM (USA)**	
	9:49407	LA—10161-MS
	9:49572	LA-UR—84-3028
	9:49722	Naturwissenschaften 71 85-92 (1984).
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	9:49886	LA-UR—84-2953
	9:49932	LA-UR—84-2815

Contract No.	Abstract No.	Report No.
	9:50132	LA-UR—84-3001
	9:50150	LA-tr—84-42(1984).
	9:50174	LA-UR—84-2936
	9:50202	LA-UR—84-2994
	9:50290	LA—10013-MS
	9:50395	LA-UR—84-1831
	9:50414	LA—10215-MS
	9:50446	LA—10080-C
	9:50448	LA-UR—84-3044
	9:50463	LA-UR—84-3043
	9:50481	LA-UR—84-2906
	9:50498	LA-UR—84-2943
	9:50499	LA-UR—84-3015
	9:50599	LA-UR—84-2927
	9:50674	LA-UR—84-2989
	9:50824	LA—10069-PR
	9:50902	LA-UR—84-2767
	9:50915	LA-UR—84-2938
	9:50916	LA-UR—84-3023
	9:50967	LA-UR—84-2750
	9:50968	LA-UR—84-2773
W-7405-ENG-48	**Lawrence Livermore National Lab., CA (USA)**	
	9:49362	UCID—20173
	9:49482	UCRL—15563
	9:49560	UCRL—53294-83
	9:49832	UCRL-Trans—12012([1984]).
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	9:49901	UCID—20211
	Structural Mechanics Associates, San Ramon, CA (USA)	
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W-7405-ENG-48		
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Contract No.	Abstract No.	Report No.
	Lawrence Livermore National Lab., CA (USA)	
	9:50178	UCID—20217
	9:50295	Talanta 30 NO. 9. 695-698 (1983).
	9:50303	UCRL—90401
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	Los Alamos National Lab., NM (USA)	
	9:50447	LA-UR—84-3007
	Lawrence Livermore National Lab., CA (USA)	
	9:50465	UCID—20175
	9:50506	UCRL—91565
	9:50512	UCRL—53566
	9:50526	DOE/NBB—0066
	9:50575	Optical Engineering 22 NO. 5. 527-531 (Sep-Oct 1983).
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W-7405-ENG-48	**Lawrence Livermore National Lab., CA (USA)**	
	9:50703	UCRL—91443
	9:50893	UCRL—91091
	9:50894	UCRL—91098
	9:51009	UCRL—90160
	9:51010	UCRL—91330
	9:51013	Computer vp (1983).
	TRW Energy Development Group, Redondo Beach, CA (USA)	
	9:51036	UCID—20166-Vol.1
	Lawrence Livermore National Lab., CA (USA)	
	9:51037	UCRL—90666
	9:51038	UCRL—91512
	9:51047	UCRL—53564
	9:51063	UCRL—91383

REPORT NUMBER INDEX

The numbers assigned to reports cited in this publication appear in the first column of the index. Cross reference information and/or availability are included as appropriate. Abbreviations used in the availability column are elaborated at the end of the index. To expedite the filling of orders for reports from NTIS and TIC, an order number in the form, DE82000001 or TI82000001, appears in column 3. Order numbers with DE prefixes may be used in ordering from both NTIS and TIC. Numbers with TI prefixes are valid at TIC only. Requesters are urged to use this order number where provided. In column 4, one or more DOE distribution categories are indicated, e.g., STD-10, MN-25. STD indicates distribution was made in full-size copy; MN indicates microcopy distribution; ND indicates no distribution was made. These category numbers are included to assist DOE librarians in responding to requests for reports in their collections. The UC (Unclassified Distribution Categories) are defined in DOE/TIC-4500, available from TIC. The citation numbers are given in column 5. NOTE: DOE attempts to disseminate its information as broadly as possible. Even though a report may contain some degree of illegibility, it is believed that the report may still make a contribution. The presence of a 1, 2, or 3 following NTIS in the availability column denotes the extent to which a report may be illegible and the form in which it is available: 1 = 1 to 5% illegibility, available PC and MF; 2 = 6 to 10% illegibility, available MF only; 3 = 11% or more illegibility, available PC only. For the users of DOE/RECON, report ordering may be accomplished more expeditiously via the on-line system. Employees of DOE or DOE contractors are urged to order from the Technical Information Center (TIC); all others should order from the National Technical Information Service (NTIS). Procedures for on-line ordering are detailed in the DOE/RECON User's Manual (DOE/TIC-4586).

Report No.	*Availability*	*File No.*	*Distribution Category*	*Abstract No.*
AAEC-LIB/Trans-				
773	NTIS (US Sales Only), PC A05/MF A01	DE84780623	MN -37	9:50487
AD-A-				
137192	*See* N-84-20982			9:50514
137751	*See* N-84-20847			9:50475
140964/ 8	NTIS MF A01			9:50067
140984/ 6	NTIS, PC A02/MF A01			9:50388
140996/ 0	NTIS MF A01			9:50068
141032/ 3	NTIS, PC A02/MF A01			9:50389
141034/ 9	NTIS, PC A08/MF A01			9:50507
141092/ 7	NTIS, PC A12/MF A01			9:50508
141113/ 1	NTIS, PC A02/MF A01			9:50360
141195/ 8	NTIS, PC A02/MF A01			9:50390
141203/ 0	NTIS, PC A06/MF A01			9:50391
141234/ 5	NTIS, PC A05/MF A01			9:50392
141241/ 0	NTIS, PC A02/MF A01			9:50450
141244/ 4	NTIS, PC A03/MF A01			9:50818
141277/ 4	NTIS, PC A03/MF A01			9:50451
141288/ 1	NTIS, PC A02/MF A01			9:50476
141312/ 9	NTIS, PC A07/MF A01			9:50509
141339/ 2	NTIS, PC A03/MF A01			9:50510
141340/ 0	NTIS, PC A04/MF A01			9:50511
142004/ 1	NTIS, PC A02/MF A01			9:49911
142428/ 2	NTIS, PC A05/MF A01			9:50628
142536/ 2	NTIS, PC A03/MF A01			9:50393
142541/ 2	NTIS, PC A02/MF A01			9:50182
AERE-G-				
2897	NTIS (US Sales Only), PC A02/MF A01	DE84703166	MN -70	9:49526
2945	NTIS (US Sales Only), PC A02/MF A01	DE84703167	MN -70	9:49527
2947	NTIS (US Sales Only), PC A02/MF A01	DE84703168	MN -70	9:49528
2950	NTIS (US Sales Only), PC A02/MF A01	DE84703169	MN -70	9:49529
2957	NTIS (US Sales Only), PC A02/MF A01	DE84703170	MN -70	9:49530
2963	NTIS (US Sales Only), PC A02/MF A01	DE84703171	MN -70	9:49531
2964	NTIS (US Sales Only), PC A02/MF A01	DE84703172	MN -70	9:49532
2995	NTIS (US Sales Only), PC A02/MF A01	DE84703173	MN -70	9:49533
3002	NTIS (US Sales Only), PC A02/MF A01	DE84703136	MN -41	9:50361
3011	NTIS (US Sales Only), PC A02/MF A01	DE84703137	MN -41	9:50362
AERE-M-				
3376	NTIS (US Sales Only), PC A02/MF A01	DE84703140	MN -41	9:50363
AFOSR-				
84-0094TR	*See* N-84-20847			9:50475
ANL-				
84-63	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001474	MN -38	9:51048
ANL/EES-TM-				
251	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE85001419	MN -95e	9:50062
ANL/FE-				
83-23	NTIS, PC A03/MF A01 (GPO Dep.)	DE85000778	STD -90h	9:49329
ANL-HEP-CP-				
84-62	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84017492	MN -25	9:50441
ANL/PHY-				
84-2	NTIS, PC A12/MF A01; 1 (GPO Dep.)	DE84017599	MN -34C	9:50456
ANL/TM-				
404-Rev.	NTIS, PC A06/MF A01 (GPO Dep.)	DE85001438	MN -32	9:51049

Report Number	Availability Source	File Number	Distribution Category	Abstract Number
ANL-Trans-				
517	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84017621	MN -4	9:50171
ANS-				
318	NTIS (US Sales Only), PC A04/MF A01	DE84703176	MN -70	9:49534
332	NTIS (US Sales Only), PC A02/MF A01	DE84703177	MN -70	9:49535
ANS-TN-J-				
249-1	NTIS (US Sales Only), PC A06/MF A01	DE84703174	MN -70	9:49536
249-3	NTIS (US Sales Only), PC A03/MF A01	DE84703175	MN -70	9:49537
AV-				
8/ 82	*See* OEFZS-4167	DE84703164	MN -83	9:49552
13/ 83	*See* OEFZS-4249	DE84703165	MN -70B	9:49553
BFR-				
94:1983	NTIS (US Sales Only), PC A03/MF A01	DE84751657	MN -59a	9:49967
BFR-R-				
103:1983	NTIS (US Sales Only), PC A02/MF A01; 1	DE84751659	MN -95f	9:50063
107:1983	NTIS (US Sales Only), PC A03/MF A01	DE84751658	MN -95d	9:50064
BG-Trans-				
5898	NTIS (US Sales Only), PC A02/MF A01; 1	DE84901725	MN -4	9:49369
BHARC-				
400/ 83/ 023	*See* RHO-BW-CR-142-P	DE85000574	MN -70B	9:49558
BHRA-				
84/ 35	NTIS PC $37.50			9:49409
84/ 43	NTIS PC $37.50			9:49418
BM-IC-				
8976	*See* PB-84-213735			9:49416
BM-RI-				
8862	*See* PB-84-213511			9:49415
BM-TPR-				
115	NTIS, PC A02/MF A01	DE84901905	MN -88	9:50364
BMFT-FB-HA-				
84-021	NTIS (US Sales Only), PC A04/MF A01; 1	DE84752107	MN -88	9:49439
BMFT-FB-T-				
83-299	*See* N-84-22025			9:49620
84-059	NTIS (US Sales Only), PC A04/MF A01	DE84752154	MN -48	9:50598
84-087	NTIS (US Sales Only), PC A04/MF A01; 1	DE84752108	MN -90b	9:49419
84-089	NTIS (US Sales Only), PC A07/MF A01; 1	DE84752106	MN -59a	9:49682
84-117	NTIS (US Sales Only), PC A08/MF A01	DE84752158	MN -04	9:50296
84-164	NTIS (US Sales Only), PC A06/MF A01	DE85750066	MN -63	9:49703
84-177	NTIS (US Sales Only), PC A04/MF A01; 1	DE85750063	MN -88	9:49410
BMFT-FB-W-				
84-019	NTIS (US Sales Only), PC A07/MF A01; 1	DE84752109	MN -96	9:50069
BMI-				
1983-021	NTIS (US Sales Only), PC A05/MF A01	DE84751539	MN -80	9:49845
1983-022	NTIS (US Sales Only), PC A06/MF A01	DE84751526	MN -78	9:49846
1983-026	NTIS (US Sales Only), PC A02/MF A01	DE84751525	MN -80	9:49796
1984-029	NTIS (US Sales Only), PC A06/MF A01	DE84751524	MN -78	9:49847
2115	*See* NUREG/CR-3988	TI85900008	MN -78	9:49894
BMI/ONWI-				
540	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE85000382	STD -70	9:49538
545	NTIS, PC A15/MF A01; 1 (GPO Dep.)	DE85000960	STD -70	9:49539
550	NTIS, PC A08/MF A01 (GPO Dep.)	DE85000788	STD -70	9:50665
BNL-				
34086	NTIS, PC A03/MF A01 (GPO Dep.)	DE84008176	MN -25	9:50172
35084	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000231	MN -28	9:50442
35124	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001344	MN -48	9:50566
35133	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001347	MN -34D	9:50457
35171	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE85001343	MN -38	9:50365
35178	NTIS, PC A03/MF A01 (GPO Dep.)	DE85001357	MN -13	9:49942
35207	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001937	MN -11	9:50520
35226	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85001345	MN -34	9:50941
35250	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000236	MN -48	9:50602
51542	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE84017240	STD -41	9:50521
51778	NTIS, PC A24/MF A01; 1 (GPO Dep.)	DE85000967	STD -34C	9:50819
51783	NTIS, PC A12/MF A01; 1 (GPO Dep.)	DE85002131	STD -41	9:50629
BNL-NUREG-				
51766	*See* NUREG/CR-3765	TI84016795	MN -79	9:49892
51775	*See* NUREG/CR-3813	TI84016805	MN -78	9:49893
BONN-HE-				
84-8	NTIS (US Sales Only), PC A02/MF A01	DE84752166	MN -34C	9:50828
CALSPAN-				
7176-A-1	*See* AD-A-142536/2			9:50393
CE-Trans-				
7930	NTIS (US Sales Only), PC A02/MF A01; 1	DE84901805	MN -86	9:49563
7966	NTIS (US Sales Only), PC A02/MF A01; 1	DE84901822	MN -78	9:49769
8006	NTIS (US Sales Only), PC A03/MF A01; 1	DE84901817	MN -38	9:49751
CEA-N-				
1434	NTIS (US Sales Only), PC A02/MF A01; 1	DE85900017	MN -48	9:50603
CEGB-TPRD/B-				
0345/ N83	NTIS (US Sales Only), PC A02/MF A01	DE84703150	MN -80	9:49802
0426/ N84	NTIS (US Sales Only), PC A03/MF A01	DE84703138	MN -41	9:49848
CH-				
307/ 82	*See* OEFZS-4165	DE84703127	MN -4	9:50347
313/ 82	*See* OEFZS-4195	DE84703128	MN -4	9:50348
329/ 84	*See* OEFZS-4273	DE84703182	MN -2	9:50257

Report Number	Availability Source	File Number	Distribution Category	Abstract Number
331/ 84	*See* OEFZS-4277	DE84703142	MN -41	9:50057
CHER-83-1	NTIS (US Sales Only), PC A03/MF A01; 1	DE85900263	MN -90a	9:49420
CLM-CD-1983-VOL.1	NTIS (US Sales Only), PC A14/MF A01	DE84780551	MN -20	9:51000
CNSNS-0004((Vol.1,2)	NTIS (US Sales Only), PC A14/MF A01	DE84703129	MN -51	9:49507
CONF-711173-	(13. Dragon Countries physics meeting, Paris, France, 18-19 Nov 1971)			
Exc.	NTIS (US Sales Only), PC A06/MF A01; 1	DE84901524	MN -77	9:49779
CONF-780611-	(AIChE symposium, Philadelphia, PA, USA, 4-8 Jun 1978)			
	AIChE Natl. Meet., No. 55a, 1-27(1978)			9:49373
	AIChE Natl. Meet., No. 55c, 1-25(1978)			9:49374
	AIChE Natl. Meet., No. 55E, 1-36(1978)			9:49375
CONF-790405-	(AIChE meeting, Houston, TX, USA, 1-5 Apr 1979)			
	AIChE Natl. Meet., No. 34D, 1-27(1979)			9:49372
CONF-8004243-	(Conference on fuel-saving driving systems, Zwickau, German D.R., 17-18 Apr 1980)			
	NTIS (US Sales Only), PC A08/MF A01; 1	DE84770472	MN -96	9:50076
CONF-8005254-	(Microelements '80 meeting, Horni Becva, Czechoslovakia, 5-7 May 1980)			
	See INIS-mf-9035	DE84780552	MN -4	9:50267
CONF-8008179-	(76. annual meeting of the American Society for Horticultural Science, Columbus, OH, USA, 1 Aug 1980)			
	HortScience, 15: No. 5, 623-629(Oct 1980)			9:50588
CONF-800997-	(Conference on the properties and performance of materials in the coal gasification environment, Pittsburgh, PA, USA, 8-10 Sep 1980)			
	American Society for Metals, Metals Park, OH 44073			9:49370
CONF-8009270-	(IFAC symposium on autom control in power generators, Pretoria, South Africa, 15-19 Sep 1980)			
1	*See* N-84-20877			9:49762
CONF-801210-	(3. Miami international conference on alternative energy sources, Miami Beach, FL, USA, 15-17 Dec 1980)			
31-Draft	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85001172	MN -90i	9:49404
CONF-8105250-	(Annual AAPG-SEPM-EMD-DPA convention, San Francisco, CA, USA, 31 May-3 Jun 1981)			
	Am. Assoc. Pet. Geol., Bull., 65: No. 5, vp(May 1981)			9:49494
CONF-8108134-	(Workshop on potential public health impacts of airborne organic combustion products, Upton, NY, USA, 17-18 Aug 1981)			
	See BNL-51542	DE84017240	STD -41	9:50521
CONF-8111215-	(National seminar on diagnostics of nuclear power plant components, Zvikovske Podhradi, Czechoslovakia, 22 Nov 1938,-24 Nov 1981)			
	See INIS-mf-9057	DE85780061	MN -80	9:49812
CONF-811236-	(Workshop on assessing health impacts of energy technologies at the regional or national levels, Upton, NY, USA, 7-8 Dec 1981)			
5	NTIS, PC A03/MF A01 (GPO Dep.)	DE85000962	MN -41	9:49440
CONF-820526-	(15. international colloquium on polluted atmospheres, Paris, France, 4-7 May 1982)			
	Stud. Environ. Sci., 8: 173-180(1980)			9:50538
	Stud. Environ. Sci., 20: 175-184(1982)			9:50647
CONF-8206259-	(Autos 82 - Automation in engineering meeting, Plzen, Czechoslovakia, 15-18 Jun 1982)			
Vol.1	*See* INIS-mf-9037	DE85780007	MN -78	9:50370
Vol.2	*See* INIS-mf-9038	DE84780617	MN -78	9:50358
Vol.3	*See* INIS-mf-9039	DE85780003	MN -41	9:50371
Vol.4	*See* INIS-mf-9036	DE85780006	MN -80	9:50369
CONF-8207112-	(22. annual congress of the South African Society of Pathologists, Stellenbosch, South Africa, 5-7 Jul 1982)			
Summs.	*See* INIS-mf-9067	DE85780058	MN -48	9:50593
CONF-8208202-	(NLC/NACo national conference on energy and local governments, Knoxville, TN, USA, 29-31 Aug 1982)			
1	Ohio Department of Energy, Columbus OH 43215	TI84901798	MN -98F	9:49947
CONF-820927-	(57. AIME Society of Petroleum Engineers annual technical conference and exhibition, New Orleans, LA, USA, 26-29 Sep 1982)			
	SPE Repr. Ser., 57: vp(1982)			9:49452
	SPE Repr. Ser., 57: vp(1982)			9:49500
CONF-8209246-	(3. symposium of the Sedimentological Division of the Geological Society of South Africa, Johannesburg, South Africa, 13-14 Sep 1982)			
Absts.	*See* INIS-mf-9069	DE85780057	MN -51	9:50659
CONF-8209256-	(American Fisheries Society annual meeting on striped bass: environmental risk in fresh and salt water, Hilton Head, SC, USA, 1 Sep 1982)			
1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84017329	MN -11	9:50563

Report Number	Availability Source	File Number	Distribution Category	Abstract Number
CONF-821084-	(Nuclear safety project annual colloquium, Karlsruhe, F.R. Germany, 26 Oct 1982)			
	See KFK-3470	DE84751913	MN -80	9:49862
CONF-8211181-	(18. Solvay conference on physics, Austin, TX, USA, 1 Nov 1982)			
	Phys. Rep., 104: No. 2-4, 113-128(Feb 1984)			9:50799
CONF-8211182-	(Meat symposium - the vital role of science and technology in the meat industry, Pretoria, South Africa, 22 Nov 1982)			
	See INIS-mf-9068	DE85780060	MN -23	9:50613
CONF-821269-	(American Society of Zoologists conference, Louisville, KY, USA, 27-30 Dec 1982)			
2-Draft	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85000961	MN -48	9:50600
CONF-821284-	(IAEA meeting on radioisotopes in sediment studies, Vienna, Austria, 13-17 Dec 1982)			
	See IAEA-TECDOC-298	DE84780553	MN -11	9:50657
CONF-821286-	(North American Economics and Finance Association meetings, New York, NY, USA, 28-30 Dec 1982)			
1	Massachusetts Institute of Technology, 50 Memorial Drive, Cambridge, MA 02139	TI85900032	MN -98	9:49944
CONF-830103-	(2. international topical meeting on nuclear reactor thermal hydraulics (ANS), Santa Barbara, CA, USA, 11-13 Jan 1983)			
46	*See* KFK-3607-B	DE84752165	MN -78	9:49871
CONF-830179-	(Energy: challenges and opportunities for the Middle Atlantic United States symposium, Baltimore, MD, USA, 10-11 Jan 1983)			
Vol.1	NTIS, PC A09/MF A01	TI84901832	MN -13	9:49945
Vol.2	NTIS MF A01	TI84901918	MN -13	9:49917
CONF-830274-	(International Union of Radio Science and COSPAR symposium on bveacon satellite studies of the earth's environment, New Delhi, India, 3-4 Feb 1983)			
	Radio Sci., 19: 707-718(May 1984)			9:50717
CONF-8303174-	(EPRI/TVA workshop on the use of biomass for the generation of electric power, Palo Alto, CA, USA, 2-3 Mar 1983)			
	See EPRI-AF-3678	TI85920041	ND -61F	9:49590
CONF-830452-	(Technical meeting on non-inductive current drive in tokamaks, Abingdon, UK, 18-21 Apr 1983)			
Vol.1	*See* CLM-CD-1983-VOL.1	DE84780551	MN -20	9:51000
CONF-8304197-	(17. scientific meeting of the Israel Society for Electron Microscopy, Rehovoth, Israel, 7 Apr 1983)			
Summ.	*See* INIS-mf-9045	DE85780034	MN -25	9:50091
CONF-8304203-	(Workshop on linkages among the global element cycles, Washington, DC, USA, 1 Apr 1983)			
1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE85001122	MN -11	9:50523
CONF-8305100-	(4. Electrochemical Society international symposium on molten salts, San Francisco, CA, USA, 8-13 May 1983)			
	Proc. - Electrochem. Soc., 84-2: 639-648(May 1983)			9:49368
	Proc. - Electrochem. Soc., 84-2: 1-11(May 1983)			9:50312
	Proc. - Electrochem. Soc., 84-2: 109-120(May 1983)			9:50313
	Proc. - Electrochem. Soc., 84-2: 225-233(May 1983)			9:50314
	Proc. - Electrochem. Soc., 84-2: 183-195(May 1983)			9:50325
	Proc. - Electrochem. Soc., 84-2: 234-247(May 1983)			9:50326
	Proc. - Electrochem. Soc., 84-2: 248-264(May 1983)			9:50327
	Proc. - Electrochem. Soc., 84-2: 359-376(May 1983)			9:50331
	Proc. - Electrochem. Soc., 84-2: 392-402(May 1983)			9:50332
	Proc. - Electrochem. Soc., 84-2: 443-450(May 1983)			9:50333
CONF-8305112-	(3. annual contractors' meeting on contaminant control in hot coal derived gas streams, Washington, PA, USA, 24-26 May 1983)			
	See DOE/METC-84-6	DE84000216	STD -90c	9:49388
CONF-830643-	(3. biennial synfuels wastewater workshop, Morgantown, WV, USA, 15-16 Jun 1983)			
	See DOE/METC-84-5	DE84009294	STD -90i	9:49387
CONF-830682-	(3. international symposium on forecasting, Philadelphia, PA, USA, 5-8 Jun 1983)			
4	Massachusetts Institute of Technology, 50 Memorial Drive, Cambridge, MA 02139	TI85900006	MN -92a	9:49444
CONF-8306126-	(American Society of Agricultural Engineers summer meeting, Bozeman, MT, USA, 26-29 Jun 1983)			
12	ASAE, 2950 Niles Rd., St. Joseph, MI 49085	TI85900077	MN -88	9:49412
CONF-8306136-	(International symposium on quarks and nuclear structure, Bad Honnef, F.R. Germany, 13-16 Jun 1983)			
3	*See* DESY-83-129	DE84751536	MN -34D	9:50775
CONF-830782-	(11. L. H. Gray conference on cellular repair of radiation damage - mechanisms and modifying agents, Glasgow, UK, 18-22 Jul 1983)			
	Br. J. Cancer, 49: No. 6, 175-185(1984)			9:50627

Report Number	Availability Source	File Number	Distribution Category	Abstract Number
CONF-830942-	(3. topical meeting on fusion reactor materials, Albuquerque, NM, USA, 19-23 Sep 1983)			
87	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001261	MN -20c	9:50095
88	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001259	MN -20c	9:51018
91-Draft	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001112	MN -25	9:50718
CONF-830970-	(International symposium on highly excited states and nuclear structure, Orsay, France, 5-8 Sep 1983)			
	J. Phys. (Paris), Colloq., 45: 327-336(Mar 1984)			9:50847
	J. Phys. (Paris), Colloq., 45: 351-355(Mar 1984)			9:50878
	J. Phys. (Paris), Colloq., 45: 305-318(Mar 1984)			9:50879
	J. Phys. (Paris), Colloq., 45: 99-114(Mar 1984)			9:50880
CONF-830971-	(8. international conference on magnet technology and exhibition, Grenoble, France, 5-9 Sep 1983)			
	J. Phys. (Paris), Colloq., 45: 575-580(Jan 1984)			9:49903
	J. Phys. (Paris), Colloq., 45: 685-690(Jan 1984)			9:50596
	J. Phys. (Paris), Colloq., 45: 615-618(Jan 1984)			9:51039
	J. Phys. (Paris), Colloq., 45: 603-606(Jan 1984)			9:51040
	J. Phys. (Paris), Colloq., 45: 637-642(Jan 1984)			9:51041
	J. Phys. (Paris), Colloq., 45: 875-880(Jan 1984)			9:51042
9	*See* KFK-3615	DE84751515	MN -25	9:50129
CONF-8309127-	(International Nuclear Target Development Society workshop, Argonne, IL, USA, 7-9 Sep 1983)			
	See ANL/PHY-84-2	DE84017599	MN -34C	9:50456
CONF-8309168-	(3. international conference on ultra-relativistic nucleus-nucleus collisions, Upton, NY, USA, 26-30 Sep 1983)			
	Nucl. Phys. A, 418: 289c-300c(23 Apr 1984)			9:50710
	Nucl. Phys. A, 418: 267c-287c(23 Apr 1984)			9:50868
	Nucl. Phys. A, 418: 501c-523c(23 Apr 1984)			9:50920
	Nucl. Phys. A, 418: 59c-85c(23 Apr 1984)			9:50921
7	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001140	MN -28	9:50443
CONF-8309253-	(1. national congress of the physicists in Bulgaria, Sofia, Bulgaria, 28 Sep-1 Oct 1983)			
Absts.	*See* INIS-mf-9052	DE84780548	MN -34D	9:50817
CONF-8309274-	(AAPG Rocky Mountain Section meeting, Billings, MT, USA, 18-21 Sep 1983)			
	Am. Assoc. Pet. Geol., Bull., 67: No. 8, 1348(Aug 1983)			9:50662
	Am. Assoc. Pet. Geol., Bull., 67: No. 8, 1348-1349(Aug 1983)			9:50663
CONF-8309276-	(22. project integration meeting, Pasadena, CA, USA, 28-29 Sep 1983)			
Summ.	*See* DOE/JPL-1012-94	DE85000334	STD -63b	9:49607
CONF-8309281-	(Workshop on neutron carcinogenesis, Oak Ridge, TN, USA, 19-20 Sep 1983)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001186	MN -48	9:50604
CONF-8309285-	(Symposium on new approaches in toxicity testing and their application to human risk assessment, St. Louis, MO, USA, 14-15 Sep 1983)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001262	MN -48	9:50630
CONF-831012-	(International symposium on use and development of low and medium flux research reactors, Cambridge, MA, USA, 17-19 Oct 1983)			
13	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002147	MN -79	9:50366
CONF-831095-	(International meeting on recovery of uranium from seawater, Tokyo, Japan, 17-18 Oct 1983)			
1	*See* GKSS-83/E/75	DE84751912	MN -02	9:49525
2	*See* GKSS-83/E/74	DE84751914	MN -02	9:49514
3	*See* GKSS-83/E/73	DE84751926	MN -02	9:49513
CONF-8310104-	(Specialists meeting on yields and decay data of fission product nuclides, Upton, NY, USA, 24-27 Oct 1983)			
	See BNL-51778	DE85000967	STD -34C	9:50819
CONF-8310265-	(International symposium on the theory of elementary particles, Ahrenshoop, German D.R., 9-15 Oct 1983)			
5	*See* KFKI-1983-128	DE84703116	MN -34C	9:50913
CONF-8310287-	(Experts' meeting: Maintenance '83, Wiesbaden, F.R. Germany, 10-12 Oct 1983)			
	See INIS-mf-8882	DE85780005	MN -25	9:50368
CONF-8310313-	(EPRI workshop on generator monitoring and surveillance, Dallas, TX, USA, 19-21 Oct 1983)			
	See EPRI-EL-3564-SR	TI85920008	ND -97d	9:49747
CONF-8310316-	(International Energy Agency meeting on biomass growth and production, Seattle, WA, USA, 17-20 Oct 1983)			
1	NTIS, PC A03/MF A01 (GPO Dep.)	DE85000968	MN -61A	9:49605
CONF-8310318-	(DeGray lake research symposium, Arkadelphia, AR, USA, 4-5 Oct 1983)			
1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85000923	MN -11	9:50564
CONF-831187-	(29. annual conference on magnetics and magnetic materials, Pittsburgh, PA, USA, 8-11 Nov 1983)			
19-Draft	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85001180	MN -34D	9:50942

Report Number	Availability Source	File Number	Distribution Category	Abstract Number
CONF-8311144-	(17. LAMPF users group meeting, Los Alamos, NM, USA, 7-8 Nov 1983)			
	See LA-10080-C	DE84014134	STD -34	9:50446
CONF-8311146-	(Symposium on optical materials for high power lasers, Boulder, CO, USA, 14-16 Nov 1983)			
6	*See* LA-UR-84-1831	DE84013897	MN -25	9:50395
CONF-8311169-	(Annual colloquium of the nuclear safety project, Karlsruhe, F.R. Germany, 21-22 Nov 1983)			
	See KFK-3670	DE84751925	MN -80	9:49875
CONF-8311183-	(3. Australian conference on nuclear techniques of analysis, Lucas Heights, Australia, 1-3 Nov 1983)			
	See INIS-mf-9065	DE84780622	MN -34A	9:50288
CONF-8311198-	(Southeastern Regional American Chemical Society meeting, Charlotte, NC, USA, 9-12 Nov 1983)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000972	MN -4	9:50259
CONF-831203-	(10. symposium on fusion engineering, Philadelphia, PA, USA, 5-9 Dec 1983)			
174	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85000952	MN -20b	9:51019
175	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85000950	MN -20b	9:51020
176	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85000949	MN -20b	9:51021
177	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85000947	MN -20	9:51022
178	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85000955	MN -20	9:51023
179	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85000957	MN -20a	9:51024
180	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85000953	MN -20	9:51025
CONF-831244-	(2. conference on municipal, hazardous and coal wastes management, Miami Beach, FL, USA, 5-7 Dec 1983)			
3	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000945	MN -90i	9:49384
CONF-831265-	(6. international conference on lasers and applications, San Francisco, CA, USA, 12-16 Dec 1983)			
5	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85000946	MN -34	9:50943
6	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001559	MN -34	9:50944
CONF-840113-	(Symposium on space nuclear power systems, Albuquerque, NM, USA, 10-13 Jan 1984)			
9	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000983	MN -80	9:49817
CONF-840142-	(International symposium on heavy ion accelerators and their applications to inertial fusion, Tokyo, Japan, 23-27 Jan 1984)			
13	*See* GSI-84-25(Prepr.)	DE84752156	MN -28	9:50474
14	*See* GSI-84-24(Prepr.)	DE84752157	MN -28	9:50461
CONF-840146-	(7. Oaxtepec meeting on nuclear physics, Oaxtepec, Mexico, 3-6 Jan 1984)			
2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85000985	MN -34D	9:50848
CONF-840171-	(Conference on composites and advanced ceramic materials, Cocoa Beach, FL, USA, 16-18 Jan 1984)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85000981	MN -25	9:50173
CONF-840202-	(17. midyear topical meeting of the Health Physics Society, Pasco, WA, USA, 5-9 Feb 1984)			
27	*See* PNL-SA-11669	DE85000361	MN -11	9:50542
CONF-840216-	(10. nuclear physics conference, Canberra, Australia, 6-8 Feb 1984)			
	See INIS-mf-9064	DE84780621	MN -34D	9:50823
CONF-840307-	(Waste management '84, Tucson, AZ, USA, 11-15 Mar 1984)			
48	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000989	MN -70	9:49540
49	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85000988	MN -70	9:49566
CONF-840311-	(4. international symposium on heating in toroidal plasmas, Rome, Italy, 21-28 Mar 1984)			
16	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000895	MN -20a	9:51001
CONF-840387-	(2. topical meeting on laser techniques in the extreme ultraviolet, Boulder, CO, USA, 5-7 Mar 1984)			
10	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000893	MN -4	9:50334
11	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85000976	MN -34A	9:50719
12	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001092	MN -34A	9:50720
13	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001266	MN -34A	9:50721
CONF-8403133-	(11. international conference on metallurgical coatings, San Diego, CA, USA, 9-13 Apr 1984)			
1	*See* N-84-20858			9:50204
CONF-8403146-	(IEA workshop on latent heat stores, Stuttgart, F.R. Germany, 5-9 Mar 1984)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001095	MN -59b	9:49718
2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001102	MN -95d	9:49969
3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001100	MN -94a	9:49906
4	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85000907	MN -94a	9:49907
CONF-8403147-	(Society of American Foresters (Northeastern Section) annual meeting, Worchester, MA, USA, 1 Mar 1984)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001094	MN -11	9:50524
CONF-8403148-	(Major Materials Facilities Committee of the National Research Council seminar, Washington, DC, USA, 17-20 Mar 1984)			
1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85001096	MN -25	9:50260

Report Number	Availability Source	File Number	Distribution Category	Abstract Number
CONF-8403150-	(DOE-OHER workshop on monitoring and dosimetry in an occupational health research program for synfuel technologies, Knoxville, TN, USA, 20-22 Mar 1984)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000973	MN -41	9:50605
2	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85000974	MN -37	9:50494
CONF-840401-	(European congress on economics and management of energy in industry, Algarve, Portugal, 2-5 Apr 1984)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001104	MN -94a	9:49905
CONF-840417-	(High-temperature alloys - theory and design conference, Bethesda, MD, USA, 8-12 Apr 1984)			
3	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000897	MN -25	9:50096
5	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85000898	MN -25	9:50945
6	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000903	MN -25	9:50097
7	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85000906	MN -25	9:50946
CONF-8404135-	(International conference on metallurgical coatings, San Diego, CA, USA, 9 Apr 1984)			
4	NTIS, PC A02/MF A01 (GPO Dep.)	DE84012979	MN -25	9:50186
CONF-8404170-	(3. international symposium on acceleration mass, Zurich, Switzerland, 10-13 Apr 1984)			
5	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85000905	MN -11	9:50655
CONF-8404190-	(Warner-Brandt workshop on penetration phenomena: in elastic near-surface interaction, Oak Ridge, TN, USA, 12-13 Apr 1984)			
3	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000899	MN -34A	9:50724
4	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000902	MN -4	9:50926
CONF-8404191-	(3. European symposium on the physico-chemical behavior of atmospheric pollutants, Vareses, Italy, 11-13 Apr 1984)			
1	*See* BNL-35207	DE85001937	MN -11	9:50520
CONF-8404192-	(Conference on progress in chemical disinfection: problems at the frontier, Binghamton, NY, USA, 13-15 Apr 1984)			
1	*See* BNL-35124	DE85001344	MN -48	9:50566
CONF-8404193-	(International symposium on silica, silicosis and cancer, Chapel Hill, NC, USA, 3-5 Apr 1984)			
Abstr.	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84017494	MN -48	9:50631
CONF-8404194-	(Association of American Geographers annual meeting, Washington, DC, USA, 21-25 Apr 1984)			
1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85001103	MN -96	9:50028
CONF-8404196-	(National Independent Coal Operators' Association annual meeting, Lexington, KY, USA, 26-28 Apr 1984)			
1	NTIS, PC A02/MF A01	DE85900023	MN -88	9:49413
CONF-840509-	(6. symposium on biotechnology for fuels and chemicals, Gatlinburg, TN, USA, 1 May 1984)			
2	*See* PNL-SA-12270	DE85000371	MN -61D	9:49586
CONF-840520-	(6. international conference on plasma surface interactions in controlled fusion devices, Nagoya, Japan, 14-18 May 1984)			
19	*See* UCRL-90160	DE85001753	MN -20b	9:51009
CONF-840530-	(International symposium on in-beam nuclear spectroscopy, Debrecen, Hungary, 14-18 May 1984)			
6	*See* GSI-84-28(Prepr.)	DE84752168	MN -34C	9:50870
CONF-840534-	(Workshop on synergistic effects in surface phenomena related to plasma-wall interactions, Nagoya, Japan, 21-22 May 1984)			
3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001861	MN -20c	9:51026
CONF-840570-	(Materials for future energy systems conference, Washington, DC, USA, 1-3 May 1984)			
14	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001873	MN -25	9:50420
CONF-8405113-	(Workshop on polarized targets in storage rings, Argonne, IL, USA, 17-18 May 1984)			
4	NTIS, PC A03/MF A01 (GPO Dep.)	DE85000095	MN -28	9:50459
CONF-8405155-	(Inner space/outer space conference, Batavia, IL, USA, 2-5 May 1984)			
4	*See* DOE/ER/40008-61	DE85001331	MN -34B	9:50669
CONF-8405193-	(Conference on the intersections between particle and nuclear physics, Steamboat Springs, CO, USA, 23-30 May 1984)			
44	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001870	MN -28	9:50444
CONF-8405207-	(Symposium on assessment of risk from low level exposure to radiation and chemicals, Upton, NY, USA, 20-23 May 1984)			
2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001867	MN -48	9:50606
3	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85000083	MN -48	9:50632
CONF-8405214-	(Molecular basis of cancer conference, Buffalo, NY, USA, 29 May-2 Jun 1984)			
2	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001875	MN -48	9:50587
CONF-8405216-	(AAPG annual convention, San Antonio, TX, USA, 20-23 May 1984)			
	Am. Assoc. Pet. Geol., Bull., 68: No. 4, 524(Apr 1984)			9:49445

Report Number	Availability Source	File Number	Distribution Category	Abstract Number
	Am. Assoc. Pet. Geol., Bull., 68: No. 4, 534(Apr 1984)			9:49476
CONF-8405231-	(International workshop on interacting boson-boson and boson-fermion systems, Gull Lake, MI, USA, 28-30 May 1984)			
8	*See* LA-UR-84-2938	DE85002040	MN -34D	9:50915
CONF-8405234-	(3. Alaska Resources conference, Seattle, WA, USA, 6-7 May 1984)			
3	Greater Seattle Chamber of Commerce, 1200 One Union Square, 6th and University, Seattle, WA 98101	TI84901838	MN -92a	9:49485
CONF-8405235-	(International congress on the prospects and problems of coal-fired power plants, Brindisi, Italy, 10-13 May 1984)			
1	*See* LA-UR-84-2727	DE84016796	MN -90i	9:49757
CONF-8405237-	(Southern regional meeting of National Council of the Paper Industry for air and stream improvement, Atlanta, GA, USA, 30 May-2 Jun 1984)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001865	MN -11	9:50545
CONF-8405239-	(Workshop on applicatons of circularly polarized synchrotron radiation, Albuquerque, NM, USA, 18-20 May 1984)			
1	*See* LA-UR-84-2927	DE85002039	MN -48	9:50599
CONF-8405240-	(Transport and propagation in nonlinear systems, Los Alamos, NM, USA, 21-25 May 1984)			
1	*See* BNL-35226	DE85001345	MN -34	9:50941
CONF-8405242-	(ACS regional meeting, Kalamazoo, MI, USA, 23-25 May 1984)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001894	MN -4	9:50261
CONF-8405243-	(5. international symposium on intracellular protein catabolism, Airlie, VA, USA, 29 May-6 Jun 1984)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001275	MN -48	9:50601
CONF-8405244-	(86. annual meeting of the American Ceramic Society, Pittsburgh, PA, USA, 2 May 1984)			
1	*See* LBL-17954	DE85002065	MN -25	9:50162
CONF-840604-	(12. international symposium on effects of radiation on materials, Williamsburg, VA, USA, 18-20 Jun 1984)			
23	NTIS, PC A03/MF A01 (GPO Dep.)	DE85001247	MN -25	9:50098
CONF-840611-	(International gas turbine conference and exhibit, Amsterdam, Netherlands, 4-7 Jun 1984)			
2	*See* N-84-20878			9:50078
CONF-840612-	(Air Pollution Control Association annual meeting, San Francisco, CA, USA, 25-28 Jun 1984)			
17	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001281	MN -11	9:50522
CONF-840614-	(Annual meeting of the American Nuclear Society, New Orleans, LA, USA, 3-8 Jun 1984)			
	Trans. Am. Nucl. Soc., 46: 413-414(Jun 1984)			9:50455
	Trans. Am. Nucl. Soc., 46: 318-319(Jun 1984)			9:50622
	Trans. Am. Nucl. Soc., 46: 317-318(Jun 1984)			9:50623
	Trans. Am. Nucl. Soc., 46: 319-320(Jun 1984)			9:50624
	Trans. Am. Nucl. Soc., 46: 319(Jun 1984)			9:50625
	Trans. Am. Nucl. Soc., 46: 641-643(Jun 1984)			9:50709
	Trans. Am. Nucl. Soc., 46: 436-438(Jun 1984)			9:50932
	Trans. Am. Nucl. Soc., 46: 435-436(Jun 1984)			9:50933
	Trans. Am. Nucl. Soc., 46: 434-435(Jun 1984)			9:50934
CONF-840617-	(12. DOE surface science/SUBWOG - 7. SUBWOG - 12B technical exchange meeting, Oak Ridge, TN, USA, 11-14 Jun 1984)			
7	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001246	MN -41	9:50183
8	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001872	MN -4	9:50329
CONF-840627-	(29. annual meeting of the Health Physics Society, New Orleans, LA, USA, 3-7 Jun 1984)			
11	*See* PNL-SA-11931	DE85000369	MN -37	9:50486
CONF-840647-	(ASME pressure vessel and piping conference, San Antonio, TX, USA, 17-21 Jun 1984)			
29	*See* PNL-SA-11947	DE85000373	MN -78	9:49814
CONF-840651-	(ASHRAE semi-annual conference, Kansas City, MO, USA, 24-28 Jun 1984)			
3	*See* LBL-17364	DE85000700	MN -95d	9:49994
CONF-8406134-	(Workshop on fundamental geochemistry needs for nuclear waste isolation, Los Alamos, NM, USA, 20-21 Jun 1984)			
2	*See* PNL-SA-12442	DE85000356	MN -70	9:50667
CONF-8406156-	(International conference on fusion reactions below the Coulomb barrier, Cambridge, MA, USA, 13-15 Jun 1984)			
4	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001280	MN -34C	9:50833
CONF-8406167-	(25. plenary session of COSPAR, Graz, Austria, 25 Jun-7 Jul 1984)			
5	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001248	MN -41	9:50607
CONF-8406194-	(NATO advanced study institute on nonequilibrium quantum statistical mechanics, Santa Fe, NM, USA, 3-16 Jun 1984)			
2	*See* LA-UR-84-2750	DE84016778	MN -34B	9:50967

Report Number	Availability Source	File Number	Distribution Category	Abstract Number
3	*See* LA-UR-84-2773	DE85002014	MN -34D	9:50968
CONF-8406198-	(Design and utilization of the superconducting super collider summer study, Snowmass, CO, USA, 23 Jun-13 Jul 1984)			
3	*See* SLAC-PUB-3427	DE85001884	MN -28	9:50454
7	*See* FNAL/C-84/73-T	DE84017259	MN -28	9:50445
CONF-8406199-	(8. Scandinavian symposium on surface chemistry, Lund, Sweden, 4-6 Jun 1984)			
1	*See* LBL-18011	DE84016879	MN -34A	9:50744
CONF-8406200-	(National Research Council of Canada's lighting control symposium, Ottawa, Canada, 28 Jun 1984, 28 Jun 1984)			
1	*See* LBL-17967	DE84015977	MN -95d	9:49995
CONF-8406201-	(8. annual geothermal conference and workshop, Seattle, WA, USA, 25-29 Jun 1984)			
	See EPRI-AP-3686	TI85920020	ND -66	9:49721
CONF-8406202-	(USENIX Association and Software Tools User Group summer conference, Salt Lake City, UT, USA, 12-15 Jun 1984)			
1	*See* LBL-18246	DE85000703	MN -32	9:51056
CONF-8406203-	(112. international Astronomical Union symposium on the search for extraterrestrial life: recent developments, Boston, MA, USA, 18-21 Jun 1984)			
1	*See* LBL-18271	DE85002069	MN -34B	9:50675
CONF-8406204-	(Workshop on management of nongame species and ecological communities, Lexington, KY, USA, 11-12 Jun 1984)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001243	MN -11	9:50546
CONF-8406205-	(National conference on environmental engineering, Los Angeles, CA, USA, 25-27 Jun 1984)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001278	MN -70	9:49541
CONF-8406206-	(Symposium on the physics of electron ejection in ion-atom and ion-solid collisions, Aarhus, Denmark, 29-30 Jun 1984)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001279	MN -34A	9:50725
CONF-8406209-	(EPA/SAF/NFPA conservation foundation workshop on effects of CO/sub 2/ increases on the forest industry, Boulder, CO, USA, 25-27 Jun 1984)			
1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85001272	MN -11	9:50547
CONF-840729-	(3. conference on slagging and fouling due to impurities in combustion gases, Copper Mountain, CO, USA, 29 Jul-3 Aug 1984)			
1	*See* DOE/FE/60181-64	DE85000916	MN -90i	9:49377
CONF-840734-	(25. annual meeting of the Institute of Nuclear Materials Management, Columbus, OH, USA, 15-18 Jul 1984)			
22	*See* PNL-SA-12398	DE85000398	MN -85	9:49523
23	*See* PNL-SA-12004	DE85000365	MN -15	9:49571
CONF-840738-	(Progress in quantitative NDE, San Diego, CA, USA, 8-13 Jul 1984)			
5	*See* Y/DW-481	DE84016843	MN -37	9:50417
6	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001288	MN -25	9:50408
7	*See* EGG-M-20984	DE85000341	MN -38	9:50410
CONF-840760-	(Ion beam modification of materials conference, Ithaca, NY, USA, 16-20 Jul 1984)			
12	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001254	MN -25	9:50184
13-Rev.	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001858	MN -25	9:50099
14	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001289	MN -25	9:50157
CONF-840763-	(MITI-USNRC seismic information exchange meeting, Palo Alto, CA, USA, 18-20 Jul 1984)			
5	*See* PNL-SA-12426	DE85000368	MN -78	9:49898
CONF-840767-	(Microbeam Analysis Society analytical electron microscopy meeting, Bethlehem, PA, USA, 19 Jul 1984)			
5	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001242	MN -25	9:50158
6	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001253	MN -25	9:50100
CONF-840781-	(International conference on environmental contamination, London, UK, 10-13 Jul 1984)			
2	*See* PNL-SA-12412	DE85000375	MN -48	9:50637
CONF-840783-	(9. international congress on photobiology, Philadelphia, PA, USA, 3 Jul 1984)			
2	*See* BNL-35250	DE85000236	MN -48	9:50602
CONF-840786-	(9. international conference on atomic physics, Seattle, WA, USA, 23-27 Jul 1984)			
3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001286	MN -34A	9:50722
CONF-840790-	(2. workshop on rf superconductivity, Geneva, Switzerland, 23-27 Jul 1984)			
2	*See* SLAC-PUB-3378	DE84017353	MN -25	9:50140
3	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002145	MN -28	9:50458
CONF-840793-	(USDOE/ORNL/PNC national topical meeting on robotics and remote handling in hostile environments, Tokyo, Japan, 24-31 Jul 1984)			
2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001901	MN -86	9:49515
5	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001897	MN -86	9:49516

Report Number	Availability Source	File Number	Distribution Category	Abstract Number
CONF-840796-	(X-Ray and UV lemission from active galactic nuclei conference, Carching, F.R. Germany, 9-13 Jul 1984)			
1	*See* LA-UR-84-2989	DE85002030	MN -34B	9:50674
CONF-840798-	(Workshop on radiolabeled free fatty acids, Amsterdam, Netherlands, 6 Jul 1984)			
1	NTIS, PC A03/MF A01 (GPO Dep.)	DE85001291	MN -48	9:50589
CONF-840802-	(ANS International topical meeting on fuel reprocessing and waste management, Jackson Hole, WY, USA, 26-29 Aug 1984)			
20	*See* PNL-SA-12522	DE85000394	MN -70	9:49557
21	*See* PNL-SA-11908	DE85000400	MN -70	9:49555
CONF-840804-	(Intersociety energy conversion engineering conference, San Francisco, CA, USA, 19-24 Aug 1984)			
51-Draft	*See* PNL-SA-11884	DE85000395	MN -94e	9:49904
52	*See* PNL-SA-12191	DE85000399	MN -94e	9:49910
CONF-840806-	(18. DOE nuclear airborne waste management and air cleaning conference, Baltimore, MD, USA, 13-16 Aug 1984)			
11	*See* PNL-SA-12000	DE85000358	MN -70	9:49556
CONF-840807-	(Conference on thermodynamics, Hamilton, Canada, 13-17 Aug 1984)			
5	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000081	MN -25	9:50297
CONF-840816-	(22. national heat transfer conference, Niagara Falls, NY, USA, 5-8 Aug 1984)			
22	*See* PNL-SA-12256	DE85000355	MN -95f	9:50061
CONF-840819-	(Doing better: setting an agenda for the second decade, Santa Cruz, CA, USA, 14-22 Aug 1984)			
12	*See* LBL-17994	DE85000319	MN -95d	9:49996
13	*See* LBL-18114	DE85000712	MN -95d	9:49997
CONF-840821-	(1. international conference on the structure of surfaces (ICSOS), Berkeley, CA, USA, 13-16 Aug 1984)			
4	*See* LBL-18080	DE85002007	MN -34A	9:50745
CONF-840828-	(International synfuels policies and technologies symposium, Philadelphia, PA, USA, 19-22 Aug 1984)			
5	*See* PNL-SA-12456	DE85000372	MN -61D	9:49587
CONF-840829-	(International conference on x-ray and inner-shell processes in atoms, molecules and solids, Leipzig, Germany D.R., 20-24 Aug 1984)			
3	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001256	MN -34A	9:50723
CONF-840842-	(17. international conference on low temperature physics, Karlsruhe, F.R. Germany, 15-22 Aug 1984)			
30	*See* LBL-18195	DE85000702	MN -38	9:50372
CONF-840849-	(Annual meeting of the American Statistical Association (ASA), Philadelphia, PA, USA, 12-16 Aug 1984)			
5	*See* PNL-SA-12457	DE85000397	MN -32	9:51059
6	*See* PNL-SA-12474	DE85000396	MN -32	9:51060
7	*See* PNL-SA-12461	DE85000370	MN -32	9:50359
CONF-840872-	(SPIE annual technical symposium, San Diego, CA, USA, 19-24 Aug 1984)			
28	*See* BNL-35171	DE85001343	MN -38	9:50365
CONF-840879-	(17. international conference on the physics of semiconductors, San Francisco, CA, USA, 6-10 Aug 1984)			
9	*See* LBL-18275	DE85002071	MN -34	9:50747
CONF-840887-	(16. international congress on high speed photography and photonics, Strasbourg, France, 27-31 Aug 1984)			
12	*See* SAND-84-1738C	DE84016723	MN -37	9:50501
CONF-840896-	(DOE hazard classification for insensitive high explosives conference, Houston, TX, USA, 28-30 Aug 1984)			
2	*See* MLM-3180(OP)	DE84016938	MN -45	9:50419
CONF-8408105-	(9. international congress of pharmacology satellite symposium, Pilsen, Czechoslovakia, 6-8 Aug 1984)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84015844	MN -41	9:50633
CONF-8408106-	(Standards in biomass for energy and chemicals workshop, Gaithersburg, MD, USA, 1-3 Aug 1984)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84015830	MN -90a	9:49376
CONF-8408108-	(Conference on precision eletromagnetic measurements, Delft, Netherlands, 20-24 Aug 1984)			
1	*See* SLAC-PUB-3396	DE85001560	MN -28	9:50464
CONF-8408109-	(Europhysics conference on software engineering, methods and tools in computational physics, Brussels, Belgium, 21-24 Aug 1984)			
1	*See* BNL-35133	DE85001347	MN -34D	9:50457
CONF-8408111-	(ISEM symposium on mathematics of plant growth form modeling at AIBS meeting, Fort Collins, CO, USA, 8 Aug 1984)			
1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85001761	MN -11	9:50548
CONF-8408116-	(12. photovoltaic concentrator project integration meeting, Albuquerque, NM, USA, 28-29 Aug 1984)			
	See SAND-84-0556	DE85001444	MN -63	9:49625

Report Number	Availability Source	File Number	Distribution Category	Abstract Number
CONF-8408117-	(3. Asian Pacific conference and workshop on electron microscopy, Singapore, Singapore, 24 Aug-2 Sep 1984)			
1	*See* LBL-18027	DE85000708	MN -25	9:50092
CONF-840901-	(ANS topical meeting on reactor physics and shielding, Chicago, IL, USA, 17-19 Sep 1984)			
15	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85000071	MN -79	9:49782
16	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000243	MN -79e	9:49849
CONF-840902-	(5. ASTM-Euratom symposium on reactor dosimetry, Geesthacht, F.R. Germany, 24-28 Sep 1984)			
10	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001545	MN -80	9:49797
11	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001546	MN -80	9:49833
CONF-840905-	(Joint power generation conference, Toronto, Canada, 30 Sep-4 Oct 1984)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001108	MN -80	9:49795
CONF-840906-	(Capture gamma-ray spectroscopy conference, Knoxville, TN, USA, 10-14 Sep 1984)			
3	*See* UCRL-91443	DE85001744	MN -34C	9:50703
4	*See* UCRL-91098	DE85001746	MN -34	9:50894
5	*See* UCRL-91091	DE85001743	MN -34	9:50893
6	*See* LA-UR-84-2767	DE85002013	MN -34C	9:50902
CONF-840914-	(International meeting on thermal nuclear reactor safety, Karlsruhe, F.R. Germany, 10-14 Sep 1984)			
16-Rev.	*See* SAND-84-0522C-kev.	DE85001447	MN -78	9:49899
CONF-840915-	(13. symposium on fusion technology, Varese, Italy, 24-28 Sep 1984)			
2	*See* UCRL-90666	DE84017568	MN -21	9:51037
3	NTIS, PC A02/MF A01 (GPO Dep.)	DE84017331	MN -20a	9:51027
CONF-840922-	(5. APS topical conference on high temperature plasma diagnostics, Tahoe City, CA, USA, 16-20 Sep 1984)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001788	MN -20	9:51002
2	*See* UCRL-91330	DE85001752	MN -20f	9:51010
6	*See* LA-UR-84-2943	DE85002035	MN -34A	9:50498
7	*See* LA-UR-84-2906	DE85002024	MN -34	9:50481
CONF-840923-	(9. European conference on thermophysical properties, Manchester, UK, 17-21 Sep 1984)			
2	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002146	MN -25	9:50185
CONF-840932-	(Meeting on plasma physics, Trieste, Italy, 24-28 Sep 1984)			
1	*See* UCRL-91512	DE84017570	MN -20	9:51038
CONF-840937-	(Applied superconductivity conference, San Diego, CA, USA, 9-13 Sep 1984)			
3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84017504	MN -20	9:51028
4-Draft	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001610	MN -20b	9:51029
5	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002103	MN -20	9:51030
6	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002112	MN -20	9:51031
8	*See* LBL-18362	DE85000701	MN -38	9:50373
CONF-840954-	(9. national passive solar conference, Columbus, OH, USA, 23-27 Sep 1984)			
6	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84017474	MN -59b	9:49683
7	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001547	MN -95d	9:49968
CONF-840963-	(DOE and DOE contractors' occupational safety and health conference, San Diego, CA, USA, 11-13 Sep 1984)			
1	*See* LA-UR-84-2815	DE85002020	MN -41	9:49932
CONF-840971-	(1. annual Pittsburgh coal conference, Pittsburgh, PA, USA, 17-21 Sep 1984)			
5	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001540	MN -90i	9:49405
CONF-8409102-	(EPS topical conference on electronic structure and properties of rare earth and actinide intermetallics, St. Polten, Austria, 3-6 Sep 1984)			
4	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001141	MN -34A	9:50102
5	*See* LA-UR-84-3001	DE85002032	MN -25	9:50132
CONF-8409103-	(5. Riso international symposium on metallurgy and materials science, Roskilde, Denmark, 1 Sep 1984)			
3	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000933	MN -25	9:50103
CONF-8409107-	(5. international conference on rapidly-quenced metals, Wurzburg, F.R. Germany, 3-7 Sep 1984)			
6	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85000930	MN -25	9:50104
7	*See* MLM-3156(OP)	DE85002117	MN -25	9:50163
CONF-8409112-	(CSNI specialist meeting on aerosols in reactor safety, Karlsruhe, F.R. Germany, 4-6 Sep 1984)			
3	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001106	MN -78	9:49853
CONF-8409117-	(2. international conference on the science of hard materials, Rhodes, Greece, 23-28 Sep 1984)			
3	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001130	MN -25	9:50159
CONF-8409129-	(3. international conference on multiphoton processes, Iraklion, Crete, Greece, 4-11 Sep 1984)			
2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001542	MN -34	9:50726
CONF-8409130-	(International conference on surface modification of metals by ion beams, Heidelberg, F.R. Germany, 17-21 Sep 1984)			
2	NTIS, PC A03/MF A01 (GPO Dep.)	DE85000943	MN -48	9:50590

Report Number	Availability Source	File Number	Distribution Category	Abstract Number
4	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001543	MN -25	9:50160
5	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85000093	MN -25	9:50105
CONF-8409132-	(International symposium composites on materials and engineering, Newark, DE, USA, 24-28 Sep 1984)			
1	*See* Y/DW-474	DE85001591	MN -38	9:50416
CONF-8409134-	(4. workshop on polarized target materials and techniques, Bonn, F.R. Germany, 2-6 Sep 1984)			
2	*See* ANL-HEP-CP-84-62	DE84017492	MN -25	9:50441
CONF-8409136-	(Joint Army-Navy-NASA-Air Force propellent characterization subcommittee meeting, Colorado Springs, CO, USA, 24-26 Sep 1984)			
1	*See* UCRL-90401	DE84017452	MN -25	9:50303
CONF-8409138-	(Integrated online library systems conference, Atlanta, GA, USA, 13-14 Sep 1984)			
1	*See* UCRL-91383	DE85001741	MN -32	9:51063
CONF-8409140-	(International conference on the properties of steam, Moscow, USSR, 3-7 Sep 1984)			
1	*See* LBL-18183	DE85000392	MN -4	9:50301
2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001544	MN -4	9:50298
CONF-8409141-	(Photochemistry of metal complexes conference, Tokyo, Japan, 2-4 Sep 1984)			
1	*See* LBL-18290	DE85000713	MN -4	9:50335
CONF-8409142-	(ECUT workshop on production and fabrication of ordered intermetallic alloys, Oak Ridge, TN, USA, 25-26 Sep 1984)			
1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE85001264	MN -25	9:50106
CONF-8409143-	(7. international conference on atomic masses and fundamental constants (AMCO-7), Darmstadt-Seeheim, F.R. Germany, 3-7 Sep 1984)			
1	*See* LA-UR-84-3022	DE85002046	MN -34C	9:50905
2	*See* LBL-18316	DE85000698	MN -34C	9:50867
CONF-8409145-	(International colloquium on the physics and physicochemistry of highly condensed matter, Aussois, France, 11-14 Sep 1984)			
1	*See* LA-UR-84-2994	DE85002033	MN -34	9:50202
CONF-8409146-	(57. annual conference of the Water Pollution Control Federation, New Orleans, LA, USA, 30 Sep 1984)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001109	MN -41	9:50568
CONF-8409147-	(20. annual meeting of the Southeastern Chapter of the Institute of Management Sciences, Myrtle Beach, SC, USA, 27-28 Sep 1984)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001133	MN -32	9:51050
CONF-8409148-	(Artificial intelligence and robotics symposium, Indianapolis, IN, USA, 12-13 Sep 1984)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000912	MN -37	9:50495
CONF-8409149-	(5. Adriatic international conference on nuclear physics: fundamental problems in heavy-ion collisions, Hvar, Yugoslavia, 24-29 Sep 1984)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001124	MN -34C	9:50834
CONF-8409150-	(12. world conference of the International Nuclear Target Development Society, Antwerp, Belgium, 25-28 Sep 1984)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000075	MN -28	9:50460
CONF-8409152-	(3. working meeting on radiation interaction, Leipzig, F.R. Germany, 24-28 Sep 1984)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85000099	MN -4	9:50346
CONF-8409153-	(TAPPI research and development conference, Appleton, WI, USA, 30 Sep-3 Oct 1984)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000913	MN -4	9:50316
CONF-8409154-	(5. international conference on titanium, Muenich, F.R. Germany, 10-14 Sep 1984)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000932	MN -25	9:50107
CONF-8409156-	(8. biennial conference on national materials policy, Fredericksburg, VA, USA, 11 Sep 1984)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001252	MN -25	9:50089
CONF-8409157-	(5. topical conference on high temperature plasma diagnostics, Lake Tahoe, NV, USA, 16-20 Sep 1984)			
1	*See* LA-UR-84-3015	DE85002042	MN -37	9:50499
CONF-8409158-	(Conference on instrumentation for heavy-ion nuclear research, Oak Ridge, TN, USA, 22-24 Sep 1984)			
1	*See* LBL-18259	DE85002067	MN -37	9:50482
CONF-841023-	(27. ORNL-DOE conference on analytical chemistry in energy technology, Knoxville, TN, USA, 2-4 Oct 1984)			
1	*See* KY/L-1328	DE85002073	MN -41	9:49565
Abstr.	NTIS, PC A03/MF A01 (GPO Dep.)	DE84017316	MN -4	9:50258
CONF-8410142-	(12. water reactor safety research information meeting, Gaithersburg, MD, USA, 23-26 Oct 1984)			
1	*See* SAND-84-1665C	DE84016722	MN -80	9:49937
CONF-8410144-	(International symposium on nuclear shell model, Philadelphia, PA, USA, 31 Oct-3 Nov 1984)			
1	*See* LA-UR-84-3023	DE85000938	MN -34C	9:50916

Report Number	*Availability Source*	*File Number*	*Distribution Category*	*Abstract Number*
CONF-8410145-	(National conference of standards laboratories, Gaithersburg, MD, USA, 1 Oct 1984)			
1	*See* SAND-84-1806C	DE84016782	MN -38	9:50502
CONF-8410147-	(Radiobiology of radium and thorotrast conference, Neuherberg, F.R. Germany, 29-31 Oct 1984)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000100	MN -48	9:50556
2	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002150	MN -48	9:50608
CONF-8410148-	(Restoration ecology: theory and practice, Madison, WI, USA, 11-12 Oct 1984)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000065	MN -88	9:50549
CONF-8410149-	(JANNAF combustion meeting, Laurel, MD, USA, 1-5 Oct 1984)			
1	*See* UCRL-91565	DE85001749	MN -4	9:50506
CONF-841115-	(International conference on power plant simulation, Mexico City, Mexico, 19-21 Nov 1984)			
3	*See* LA-UR-84-2953	DE85002036	MN -78	9:49886
CONF-841117-	(8. conference on the application of accelerators in research and industry, Denton, TX, USA, 12-14 Nov 1984)			
3	*See* LA-UR-84-3007	DE85002043	MN -28	9:50447
4	*See* LA-UR-84-3043	DE85002048	MN -28	9:50463
5	*See* LA-UR-84-3044	DE85002047	MN -28	9:50448
6	*See* LA-UR-84-3028	DE85002045	MN -28	9:49572
CONF-841122-	(Symposium on new technologies in nuclear power plant instrumentation and control, Washington, DC, USA, 28-30 Nov 1984)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84011727	MN -80	9:49850
CONF-841124-	(Scientific conference on chemical defense research, Millersville, MD, USA, 1 Nov 1984)			
1	*See* BNL-34086	DE84008176	MN -25	9:50172
CONF-841142-	(Symposium on environmental research for actinide elements, Hilton Head Island, SC, USA, 7-11 Nov 1984)			
1	*See* PNL-SA-12152	DE84008644	MN -11	9:50561
CONF-841157-	(Symposium on the scientific basis for nuclear waste management, Boston, MA, USA, 26-29 Nov 1984)			
4	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000080	MN -25	9:50101
CONF-841174-	(5. information exchange meeting on debris coolability, Los Angeles, CA, USA, 7-9 Nov 1984)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84014682	MN -80	9:49851
4	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002104	MN -78	9:49852
CONF-841196-	(1. international machine tool engineers conference, Tokyo, Japan, 7-8 Nov 1984)			
1	*See* UCRL-91531	DE85001751	MN -38	9:50382
CONF-841198-	(ASCE dredging conference, Clearwater, FL, USA, 14-16 Nov 1984)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84015843	MN -38	9:50567
CONF-8411100-	(International conference on applied lasers and electro optics, Boston, MA, USA, 12-15 Nov 1984)			
1	*See* SAND-84-1300C	DE85001804	MN -38	9:50139
CONF-8411102-	(Conference on metal and ceramic matrix composite processing, Columbus, OH, USA, 12-15 Nov 1984)			
1	*See* LA-UR-84-2936	DE85002038	MN -25	9:50174
CONF-8411104-	(Fall conference of the Society for Experimental Mechanics, Milwaukee, WI, USA, 4-7 Nov 1984)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001550	MN -25	9:50409
COO-				
4321A-4	*See* DOE/EV/04321-4	DE85002098	MN -4	9:50714
DESY-				
83-123	NTIS (US Sales Only), PC A02/MF A01	DE84751509	MN -34D	9:50762
83-124	NTIS (US Sales Only), PC A02/MF A01	DE84751510	MN -28	9:50473
83-125	NTIS (US Sales Only), PC A02/MF A01	DE84751511	MN -34D	9:50772
83-126	NTIS (US Sales Only), PC A02/MF A01	DE84751512	MN -34D	9:50773
83-127	NTIS (US Sales Only), PC A02/MF A01	DE84751513	MN -34D	9:50774
83-128	NTIS (US Sales Only), PC A02/MF A01	DE84751535	MN -32	9:50800
83-129	NTIS (US Sales Only), PC A03/MF A01	DE84751536	MN -34D	9:50775
83-131	NTIS (US Sales Only), PC A04/MF A01	DE84751537	MN -34D	9:50776
84-001	NTIS (US Sales Only), PC A02/MF A01	DE84751529	MN -34D	9:50763
84-002	NTIS (US Sales Only), PC A02/MF A01	DE84751530	MN -34D	9:50801
84-003	NTIS (US Sales Only), PC A02/MF A01	DE84751531	MN -34D	9:50777
84-004	NTIS (US Sales Only), PC A02/MF A01	DE84751532	MN -34D	9:50764
84-005	NTIS (US Sales Only), PC A02/MF A01	DE84751533	MN -34D	9:50765
84-008	NTIS (US Sales Only), PC A02/MF A01	DE84751534	MN -34D	9:50766
84-018	NTIS (US Sales Only), PC A02/MF A01	DE84751920	MN -34D	9:50802
84-019	NTIS (US Sales Only), PC A02/MF A01	DE84751921	MN -34D	9:50778
84-026	NTIS (US Sales Only), PC A03/MF A01	DE84752171	MN -28	9:50452
84-032	Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)			9:50767
DFVLR-FB-				
84-10	NTIS (US Sales Only), PC A09/MF A01; 1	DE84752111	MN -60	9:49733
DOE/BC/10033-				
10	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84012730	STD -92a	9:49446
DOE/BC/10321-				
16	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE85000105	STD -92a	9:49447

Report Number	Availability Source	File Number	Distribution Category	Abstract Number
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280	NTIS, PC A11/MF A01; 1 (GPO Dep.)	DE85002111	MN -11	9:50582
287	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84017144	MN -95	9:49601
326	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85000487	MN -63	9:49653
DOE/CA/10004-				
T1	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84007310	MN -61E	9:49578
DOE/CE-				
0101	NTIS, PC A04/MF A01 (GPO Dep.)	DE85000204	STD -95d	9:49955
DOE/CE/30760-				
T1	NTIS, PC A06/MF A01 (GPO Dep.)	DE84017325	STD -61D	9:49589
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T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000479	MN -95f	9:50034
T2	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85000480	MN -95f	9:49970
DOE/CH/00178-				
T23	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE85001305	MN -58	9:49603
DOE/CS/30012-				
T1	NTIS, PC A04/MF A01 (GPO Dep.)	DE84017265	MN -58	9:49684
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T3	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85000547	MN -95f	9:49971
T4	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85000545	MN -95f	9:49972
T5	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE85000544	MN -95f	9:50035
T6	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85000481	MN -95f	9:49973
T7	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000476	MN -95f	9:49974
T8	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85000549	MN -95f	9:49975
T9	NTIS, PC A03/MF A01 (GPO Dep.)	DE85000482	MN -95f	9:49976
T10	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE85001614	MN -95f	9:49977
T11	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85000477	MN -95f	9:49978
T12	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85000478	MN -95f	9:49979
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DOE/CS/55138-				
T1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE85000739	MN -96	9:50029
DOE/CS/69095-				
3	NTIS, PC A10/MF A01 (GPO Dep.)	DE85001005	MN -98D	9:49959
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0239	NTIS, PC A04/MF A01 (GPO Dep.)	DE85001138	MN -11	9:50583
DOE/EI/02295-				
T2	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE85000718	MN -95f	9:50036
DOE/EIA-				
0109(84/ 07)	NTIS, PC A06/MF A01; 1 - GPO (GPO Dep.)	DE85001166	MN -98B	9:49454
0125(84/ 2Q)	NTIS, PC A05/MF A01 - GPO (GPO Dep.)	DE85001244	MN -98A	9:49435
0130(84/ 07)	NTIS, PC A07/MF A01; 1 - GPO (GPO Dep.)	DE85000303	MN -98C	9:49478
0333(84)	NTIS, PC A03/MF A01; 1 - GPO (GPO Dep.)	DE85001705	MN -98A	9:49436
0380(84/ 07)	NTIS, PC A07/MF A01; 1 - GPO (GPO Dep.)	DE85000472	MN -98B	9:49455
DOE/EIS-				
0108D-Vol.1	NTIS, PC A16/MF A01; 1 (GPO Dep.)	DE85001018	MN -11	9:50584
0108D-Vol.2	NTIS, PC A99/MF A01; 1 (GPO Dep.)	DE85001017	MN -11	9:50585
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429	NTIS, PC A03/MF A01 (GPO Dep.)	DE85002012	STD -11	9:50557
431	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE85002011	STD -11	9:50539
DOE/ER-				
0143/ 2	NTIS, PC A11/MF A01 (GPO Dep.)	DE85001470	STD -25	9:50090
0144/ 2	NTIS, PC A06/MF A01 (GPO Dep.)	DE84016032	MN -4	9:50256
0145/ 2	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE85001882	STD -11	9:50654
0147/ 2	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE85002121	MN -48	9:49606
0202	NTIS, PC A07/MF A01 (GPO Dep.)	DE85001245	STD -11	9:50525
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T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84015661	MN -34A	9:50727
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223	NTIS, PC A04/MF A01 (GPO Dep.)	DE85000571	MN -38	9:50398
DOE/ER/03346-				
257	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85001336	MN -34C	9:50869
DOE/ER/03509-				
20	NTIS, PC A13/MF A01; 1 (GPO Dep.)	DE84016543	MN -34D	9:50759
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25	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE85001906	MN -34C	9:50820
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T4	NTIS, PC A03/MF A01 (GPO Dep.)	DE85002093	MN -34A	9:50728
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2	NTIS, PC A03/MF A01 (GPO Dep.)	DE85000350	MN -4	9:50263
3-Pt.1	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE85001107	MN -4	9:50264
3-Pt.2	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE85000937	MN -4	9:50265
DOE/ER/10990-				
T2	NTIS, PC A03/MF A01 (GPO Dep.)	DE85000057	MN -21	9:50394

Report Number	Availability Source	File Number	Distribution Category	Abstract Number
DOE/ER/12099-T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000568	MN -11	9:50666
DOE/ER/13004-2	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002087	MN -34	9:50317
DOE/ER/13126-T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000958	MN -4	9:50176
DOE/ER/13164-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002118	MN -38	9:50399
DOE/ER/40007-26	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE85000062	MN -34	9:50821
DOE/ER/40008-61	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001331	MN -34B	9:50669
DOE/ER/60169-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001943	MN -41	9:50609
DOE/ER/70262-T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85000207	MN -90	9:49330
DOE/ER/75016-T3	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE85002139	MN -25	9:50177
DOE/ET/10577-T3	NTIS, PC A02/MF A01 (GPO Dep.)	DE84017248	STD -90h	9:50109
DOE/ET/13617-T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85000567	MN -90d	9:49426
DOE/ET/15492-T58	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016291	MN -90i	9:49385
DOE/ET/20356-15	NTIS, PC A03/MF A01 (GPO Dep.)	DE85000329	STD -63	9:49602
DOE/ET/20643-T4	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE85001611	MN -59a	9:49685
DOE/ET/25003-T1	NTIS, PC A14/MF A01; 1 (GPO Dep.)	DE85001324	MN -97a	9:49758
DOE/ET/29366-1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85001146	MN -97	9:49743
DOE/ET/34014-16	NTIS (US Sales Only), PC A03/MF A01 (GPO Dep.)	DE85002113	STD -78	9:49770
DOE/ET/34015-8	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE85001443	STD -78	9:49771
DOE/ET/53003-2	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001777	MN -20g	9:51003
3	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001778	MN -20g	9:51004
DOE/ET/53088-154-Pt.A	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE85001590	MN -20g	9:51005
154-Pt.B	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE85001787	MN -20g	9:51006
DOE/EV/03861-49	NTIS, PC A03/MF A01 (GPO Dep.)	DE85000305	MN -34	9:50927
DOE/EV/04321-4	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002098	MN -4	9:50714
T2	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002099	MN -4	9:50318
DOE/EV/10252-T2	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85000720	MN -92a	9:50634
DOE/EV/10472-T2	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85000728	MN -92a	9:49467
T3	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000724	MN -92a	9:49468
T4	NTIS, PC A03/MF A01 (GPO Dep.)	DE85000725	MN -11	9:49927
T5	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85000723	MN -92	9:49469
T6	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000726	MN -92a	9:49456
T7	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE85000727	MN -90j	9:49442
DOE/FE/60177-1664	NTIS, PC A03/MF A01 (GPO Dep.)	DE85001459	STD -91	9:49496
DOE/FE/60181-64	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000916	MN -90i	9:49377
1642	NTIS, PC A12/MF A01; 1 (GPO Dep.)	DE84017327	STD -90	9:49378
DOE/FE/60338-13	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85001946	MN -93	9:49962
DOE/ID-12228	NTIS, PC A11/MF A01; 1 (GPO Dep.)	DE85001173	MN -70B	9:49564
DOE/IG-0211	USDOE-TIC, PO Bx 62, Oak Ridge, TN 37830	TI85000917	MN -13	9:49923
0212	USDOE-TIC, PO Bx 62, Oak Ridge, TN 37830	TI85000909	MN -13	9:51046
DOE/JPL-1012-94	NTIS, PC A99/MF A01; 1 (GPO Dep.)	DE85000334	STD -63b	9:49607
1060-66	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE85000337	STD -62b	9:49663
1060-74	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE85000323	STD -62b	9:49664
1060-75	NTIS, PC A03/MF A01 (GPO Dep.)	DE85000322	STD -62b	9:49665
DOE/JPL/1060-76	NTIS, PC A03/MF A01 (GPO Dep.)	DE85000352	STD -62b	9:49666
DOE/JPL/955392-3	NTIS, PC A05/MF A01 (GPO Dep.)	DE85001360	STD -63b	9:49608
DOE/JPL/956312-08	NTIS, PC A04/MF A01 (GPO Dep.)	DE85001707	STD -63b	9:50187
DOE/JPL/956615-84/ 3	NTIS, PC A03/MF A01 (GPO Dep.)	DE85001706	STD -63b	9:49609
DOE/JPL/956786-84/ 1	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001383	STD -63b	9:49610

Report Number	Availability Source	File Number	Distribution Category	Abstract Number
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6Te	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000920	MN -70B	9:49543
6Tf	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000304	MN -70B	9:49544
32T	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE85001167	STD -70B	9:49545
33T	NTIS, PC A03/MF A01 (GPO Dep.)	DE85000921	STD -70B	9:49546
34T	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000922	STD -70B	9:49547
DOE/MC/08707-				
T1	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84017558	MN -90c	9:49386
DOE/MC/16551-				
14	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000345	MN -92a	9:49448
DOE/MC/20013-				
T7	NTIS MF A01; 2 (GPO Dep.)	DE85001449	MN -92a	9:49488
DOE/MC/20693-				
T10	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001014	MN -92a	9:49489
DOE/METC-				
84-5	NTIS, PC A11/MF A01; 1 (GPO Dep.)	DE84009294	STD -90i	9:49387
84-6	NTIS, PC A21/MF A01; 1 (GPO Dep.)	DE84000216	STD -90c	9:49388
84-26-Vol.3-Pt.1	NTIS, PC A23/MF A01; 1 (GPO Dep.)	DE84012008	STD -90h	9:49401
DOE/METC/SP-				
207	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84011991	STD -92a	9:49474
DOE/NASA-				
0017-2	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85001154	STD -97d	9:49965
DOE/NBB-				
0066	NTIS, PC A04/MF A01 (GPO Dep.)	DE85000492	STD -11	9:50526
DOE/NBM-				
4006805	Facts on File Inc., 460 Park Ave., New York, NY 10016	TI84006805	ND -59a	9:49702
4016871	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84016871	MN -95	9:50065
5000722	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE85000722	MN -97e	9:49593
5001189	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001189	MN -80	9:49834
5001191	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001191	MN -98B	9:49473
5001730	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE85001730	MN -97e	9:49594
DOE/NE-				
0059	NTIS, PC A17/MF A01; 1 (GPO Dep.)	DE84017643	STD -79	9:49791
DOE/NV/10354-				
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DOE/OR/03054-				
51	NTIS, PC A04/MF A01 (GPO Dep.)	DE85001489	STD -89	9:49345
113	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE85001488	STD -89	9:49346
T11-Suppl.	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE85001446	STD -90d	9:49347
T22	NTIS, PC A11/MF A01; 1 (GPO Dep.)	DE85000465	MN -89	9:49348
T26-Vol.2	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE85001467	MN -89	9:49349
T26-Vol.4	NTIS, PC A14/MF A01; 1 (GPO Dep.)	DE85001465	MN -89	9:49350
T26-Vol.5	NTIS, PC A15/MF A01; 1 (GPO Dep.)	DE85001464	MN -89	9:49351
DOE/OR/20722-				
15	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85000629	STD -70A	9:49567
DOE/OR/21400-				
T47	NTIS, PC A04/MF A01 (GPO Dep.)	DE85001093	MN -95d	9:49980
DOE/PC/40784-				
T4	NTIS, PC A11/MF A01; 1 (GPO Dep.)	DE85000216	STD -90d	9:49352
DOE/PC/40810-				
10	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000705	MN -90d	9:49353
DOE/PC/50001-				
23	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE85001165	STD -90d	9:49354
DOE/PC/50797-				
T7	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84017396	MN -90b	9:49382
DOE/PC/60044-				
T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84017334	STD -90a	9:50299
T2	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85001629	STD -90d	9:49355
DOE/PC/60047-				
T4	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE85001156	STD -90d	9:49356
DOE/PC/72007-				
2	NTIS, PC A03/MF A01 (GPO Dep.)	DE85000570	STD -90b	9:49383
DOE/PE/70025-				
T1	NTIS, PC A13/MF A01 (GPO Dep.)	DE85000061	MN -98E	9:49934
DOE/PE/70267-				
T4	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE85001581	MN -92	9:49457
T5	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85001583	MN -98C	9:49479
T6	NTIS, PC A03/MF A01 (GPO Dep.)	DE85001579	MN -92	9:49458
T7	NTIS, PC A03/MF A01 (GPO Dep.)	DE85001580	MN -92	9:49459
T8	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE85001582	MN -92	9:49460
DOE/R4/10161-				
T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000221	MN -95	9:49734
DOE/R4/10233-				
T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000223	MN -97e	9:49595
DOE/R4/10320-				
T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85000311	MN -95	9:50066
DOE/R4/10484-				
T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000312	MN -95	9:49981
DOE/R4/10487-				
T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85000377	MN -59a	9:49704
DOE/R4/10499-				
T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001153	MN -95d	9:49982

Report Number	Availability Source	File Number	Distribution Category	Abstract Number
DOE/RA/50156-				
5	NTIS, PC A03/MF A01 (GPO Dep.)	DE84017051	STD -97a	9:49759
DOE/RG/03365-				
T1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE85000459	MN -91	9:49504
DOE/RL/01830-				
T30	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001584	MN -90c	9:49357
DOE/SF/00115-				
T11	NTIS, PC A11/MF A01; 1 (GPO Dep.)	DE85002061	MN -25	9:50110
DOE/SF/10501-				
004	NTIS, PC A02/MF A01 (GPO Dep.)	DE84017036	MN -62a	9:49678
014	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001376	MN -62	9:49912
017	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85001374	MN -62	9:49667
019	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE85001375	MN -62	9:49668
059	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE85001370	MN -62	9:49669
060	NTIS MF A01; 2 (GPO Dep.)	DE85001380	MN -62	9:49670
063	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84017040	MN -62a	9:49671
DOE/TIC-				
3389-Suppl.1	NTIS, PC A17/MF A01 (GPO Dep.)	DE84013656	STD -70	9:49548
27601	NTIS$29.50; 1 (GPO Dep.)	DE84005177	STD -11	9:50527
DOE-tr-				
4017301	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84017301	MN -25	9:49509
5002149	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002149	MN -90c	9:49367
DOT-I-				
83-32	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE85000740	MN -96	9:50030
84-28	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE85000738	MN -96	9:50031
DP-				
83-125-3	NTIS, PC A11/MF A01; 1 (GPO Dep.)	DE85000959	STD -70	9:49549
1674	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE85000716	STD -37	9:50496
DPST-				
84-1-6	NTIS, PC A02/MF A01 (GPO Dep.)	DE84017093	MN -2	9:49517
DREO-TN-				
83-25	*See* AD-A-142004/1			9:49911
E-				
1855	*See* N-84-20878			9:50078
2004	*See* N-84-20858			9:50204
ECN-				
155	NTIS (US Sales Only), PC A06/MF A01	DE84703158	MN -79	9:49783
ECRC/M-				
1773	*See* PB-84-202001			9:49688
1784	*See* PB-84-205376			9:50007
EEB-BED-				
84-02	*See* LBL-17364	DE85000700	MN -95d	9:49994
84-03	*See* LBL-17994	DE85000319	MN -95d	9:49996
EEB-L-				
84-10	*See* LBL-18114	DE85000712	MN -95d	9:49997
EGG-				
2315	*See* NUREG/CR-3824	TI85900039	MN -78	9:49765
2330	NTIS, PC A03/MF A01 (GPO Dep.)	DE85001445	STD -97e	9:49592
EGG-EA-				
6703	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001451	MN -32	9:51051
EGG-M-				
08484	NTIS, PC A02/MF A01 (GPO Dep.)	DE84017234	MN -78	9:49854
20984	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000341	MN -38	9:50410
EGG-PBS-				
6689	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000342	MN -37	9:50497
EIR-				
502	*See* KFK-3636	DE84751523	MN -80	9:49872
516	NTIS (US Sales Only), PC A04/MF A01; 1	DE85750067	MN -13	9:49919
ENEA-RT/BIO-				
82-21	NTIS (US Sales Only), PC A03/MF A01	DE84703134	MN -48	9:50610
ENEA-RT/PROT-				
83-9	NTIS (US Sales Only), PC A04/MF A01	DE84703135	MN -23	9:50611
83-17	NTIS (US Sales Only), PC A02/MF A01	DE84703178	MN -70	9:49550
EPA-				
520/ 5-83-027	NTIS, PC A03/MF A01	TI84901258	MN -11	9:50576
EPA/450/4-				
84-002	*See* PB-84-198746			9:50531
EPA/600-				
D-84-164	*See* PB-84-209097			9:50432
D-84/ 170	*See* PB-84-211259			9:50434
EPRI-AP-				
3578	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920031	ND -60	9:49735
3580	NTIS, PC A20/MF A01; 1 - EPRI (GPO Dep.)	DE85001911	MN -90d	9:49358
3651	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920024	ND -90f	9:50431
3665-SR	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920040	ND -62	9:49604
3678	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920041	ND -61F	9:49590
3686	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920020	ND -66	9:49721

Report Number	Availability Source	File Number	Distribution Category	Abstract Number
EPRI-CS-				
3644	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920012	ND -11	9:49745
3716	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920011	ND -38	9:49746
EPRI-EA-				
3622	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920453	ND -97c	9:49956
3671	NTIS, PC A12/MF A01; 1 - EPRI (GPO Dep.)	DE85001910	MN -11	9:50528
EPRI-EL-				
3564-SR	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920008	ND -97d	9:49747
EPRI-EM-				
3676	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920009	ND -59b	9:49686
EPRI-NP-				
2314	*See* NUREG/CR-2576	TI85900036	MN -78	9:49889
3446	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920015	ND -78	9:49803
3632	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920546	ND -97c	9:49933
3663	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920007	ND -78	9:49766
EUR-				
7937	NTIS PC E09/MF E09			9:49611
7937-EN	*See* EUR-7937			9:49611
8248-IT	*See* PB-84-211747			9:49575
8370-EN/ FR	*See* PB-84-215110			9:50018
8406	NTIS PC E08/MF E08			9:49414
8406-DE	*See* EUR-8406			9:49414
8539-FR	*See* PB-84-212497			9:49909
8547-EN/ FR	*See* PB-84-214790			9:49580
8554-FR	*See* PB-84-214956			9:49960
8590-FR	*See* PB-84-213271			9:49731
8666-FR	*See* PB-84-211663			9:49591
8871-EN	*See* PB-84-212554			9:49724
FCR-				
6444F	*See* DOE/FE/60338-13	DE85001946	MN -93	9:49962
FE-				
1765-6	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84017297	MN -90h	9:49328
FEI-				
1489	NTIS (US Sales Only), PC A02/MF A01	DE84703146	MN -38	9:50400
1497	NTIS (US Sales Only), PC A02/MF A01	DE84703153	MN -80	9:49815
FIZ-KA-				
6	*See* NEANDC(E)-242-U(Vol.5)	DE84703122	MN -34C	9:50825
FMI-OR-				
106	NTIS (US Sales Only), PC A04/MF A01; 1	DE84751667	MN -11	9:50529
FNAL/C-				
84/ 73-T	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84017259	MN -28	9:50445
FPA-				
83-7	*See* KFK-3680	DE84752167	MN -20	9:51033
FR-				
80-69/ EE	*See* PB-84-215789			9:49585
FTD-ID(RS)T-				
1647-83	*See* N-84-20982			9:50514
FZA-				
25-123	NTIS, PC A07/MF A01; 1	DE84901877	MN -33	9:49843
GAO/RCED-				
84-17	US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760	TI85900085	MN -98A	9:49437
84-22	US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760	TI84901871	MN -98E	9:49957
84-27	General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760	TI85900095	MN -80	9:49792
84-43	General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760	TI85900094	MN -80	9:49855
84-44	General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760	TI84901489	MN -11	9:49928
84-46	US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760	TI85900198	MN -98A	9:49438
84-79	General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760	TI85900199	MN -11	9:49929
84-116	US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760	TI84901516	MN -97e	9:49597
84-143	General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760	TI85900087	MN -97e	9:49598
84-168	US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760	TI84901899	MN -90j	9:49953
84-178	US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760	TI85900098	MN -98C	9:49480
84-180	US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760	TI85900097	MN -98B	9:49951
84-190	General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760	TI85900096	MN -22	9:49524

Report Number	Availability Source	File Number	Distribution Category	Abstract Number
GEAP-				
22054	*See* NUREG/CR-2576	TI85900036	MN -78	9:49889
GEMP-				
395	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84017121	MN -80	9:49784
GESAMP-				
19	NTIS (US Sales Only), PC A09/MF A01	DE84703130	MN -11	9:50577
GJ/TMC-				
15	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE85002092	STD -70A	9:49568
GKSS-				
82/ E/ 57	NTIS (US Sales Only), PC A02/MF A01	DE84751538	MN -4	9:49508
83/ E/ 42	NTIS (US Sales Only), PC A03/MF A01; 1	DE84752110	MN -60	9:49736
83/ E/ 57	NTIS (US Sales Only), PC A02/MF A01	DE84751519	MN -70	9:50569
83/ E/ 73	NTIS (US Sales Only), PC A02/MF A01	DE84751926	MN -02	9:49513
83/ E/ 74	NTIS (US Sales Only), PC A02/MF A01	DE84751914	MN -02	9:49514
83/ E/ 75	NTIS (US Sales Only), PC A02/MF A01	DE84751912	MN -02	9:49525
84/ E/ 3	NTIS (US Sales Only), PC A02/MF A01	DE84751918	MN -37	9:50477
84/ E/ 6	NTIS (US Sales Only), PC A12/MF A01	DE84752170	MN -04	9:50266
84/ E/ 7	NTIS (US Sales Only), PC A05/MF A01	DE84752113	MN -25	9:50188
84/ E/ 15	NTIS (US Sales Only), PC A02/MF A01; 1	DE85750068	MN -25	9:50111
84/ E/ 17	NTIS (US Sales Only), PC A10/MF A01; 1	DE85750069	MN -25	9:50112
GL-				
3715	*See* AD-A-140984/6			9:50388
GRI-				
83/ 0028	*See* LBL-16518	DE85001418	MN -92a	9:49477
83/ 0047	*See* UCRL-15563	DE85000999	MN -92a	9:49482
GRS-A-				
757	Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Garching (Germany, F.R.)			9:49793
849	*See* BMI-1983-022	DE84751526	MN -78	9:49846
863	*See* BMI-1983-026	DE84751525	MN -80	9:49796
GSF-A-				
2/ 84	Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg, Germany, F.R.	TI85750065	ND -11	9:50635
GSF-B-				
1521	NTIS (US Sales Only), PC A05/MF A01	DE84751518	MN -48	9:50591
GSF-R-				
296	NTIS (US Sales Only), PC A08/MF A01	DE84751508	MN -11	9:50656
GSI-				
83-14	NTIS (US Sales Only), PC A03/MF A01	DE84751514	MN -34C	9:50822
84-3	NTIS (US Sales Only), PC A06/MF A01	DE84751927	MN -34C	9:50882
84-24(Prepr.)	NTIS (US Sales Only), PC A02/MF A01	DE84752157	MN -28	9:50461
84-25(Prepr.)	NTIS (US Sales Only), PC A02/MF A01	DE84752156	MN -28	9:50474
84-28(Prepr.)	NTIS (US Sales Only), PC A02/MF A01	DE84752168	MN -34C	9:50870
HDL-TR-				
2041	*See* AD-A-141195/8			9:50390
HEDL-				
7376-Rev.1	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE85000348	MN -70	9:50367
HMI-B-				
403	NTIS (US Sales Only), PC A08/MF A01	DE84751520	MN -34	9:50928
HMI-P-				
27/ 83-HF(Prepr.)	NTIS (US Sales Only), PC A04/MF A01	DE84751507	MN -34C	9:50897
IA-				
98/ 80	*See* OEFZS-4050	DE84703162	MN -37	9:50291
126/ 84	*See* OEFZS-4265	DE84703145	MN -23	9:49573
128/ 84	*See* OEFZS-4274	DE84703144	MN -23	9:50483
IAEA-TECDOC-				
298	NTIS (US Sales Only), PC A05/MF A01	DE84780553	MN -11	9:50657
ICTIS/TR-				
26	NTIS (US Sales Only), PC A04/MF A01	TI84901801	STD -90c	9:49359
IKE-				
4-113	NTIS (US Sales Only), PC A05/MF A01	DE84751929	MN -80	9:49798
INDC(FR)-				
59-L	*See* NEANDC(E)-230-L	DE84703118	MN -34C	9:50827
INDC(GER)-				
25-L	*See* NEANDC(E)-242-U(Vol.5)	DE84703122	MN -34C	9:50825
INDC(JAP)-				
82-L	*See* NEANDC(J)-95-U	DE84900751	MN -34C	9:50844
INDC(JPN)-				
90/ L	*See* NEANDC(J)-104/U	TI84901850	ND -34C	9:50845
91/ L	*See* NEANDC(J)-105/U	TI84901864	ND -34C	9:50846
INER-				
0494	NTIS (US Sales Only), PC A02/MF A01	DE85900133	MN -4	9:50300
0498	NTIS (US Sales Only), PC A03/MF A01; 1	DE85900132	MN -32	9:50929
0503	NTIS (US Sales Only), PC A03/MF A01; 1	DE85900141	MN -32	9:51052
0514	NTIS (US Sales Only), PC A03/MF A01	DE85900149	MN -32	9:50978
INIS-mf-				
8798	NTIS (US Sales Only), PC A04/MF A01	DE85780002	MN -23	9:50592
8882	NTIS (US Sales Only), PC A19/MF A01	DE85780005	MN -25	9:50368
8884	NTIS (US Sales Only), PC A02/MF A01	DE84780549	MN -34D	9:50803
9007	NTIS (US Sales Only), PC A04/MF A01	DE85780004	MN -23	9:50935
9035	NTIS (US Sales Only), PC A03/MF A01	DE84780552	MN -4	9:50267
9036	NTIS (US Sales Only), PC A04/MF A01	DE85780006	MN -80	9:50369
9037	NTIS (US Sales Only), PC A02/MF A01	DE85780007	MN -78	9:50370
9038	NTIS (US Sales Only), PC A02/MF A01	DE84780617	MN -78	9:50358

Report Number	Availability Source	File Number	Distribution Category	Abstract Number
9039	NTIS (US Sales Only), PC A03/MF A01	DE85780003	MN -41	9:50371
9042	NTIS (US Sales Only), PC A04/MF A01	DE85780009	MN -2	9:49935
9043	NTIS (US Sales Only), PC A05/MF A01	DE85780010	MN -2	9:49936
9045	NTIS (US Sales Only), PC A03/MF A01	DE85780034	MN -25	9:50091
9052	NTIS (US Sales Only), PC A99/MF A01	DE84780548	MN -34D	9:50817
9054	NTIS (US Sales Only), PC A02/MF A01	DE85780008	MN -80	9:49836
9057	NTIS (US Sales Only), PC A07/MF A01	DE85780061	MN -80	9:49812
9063	NTIS (US Sales Only), PC A03/MF A01	DE84703107	MN -20	9:51007
9064	NTIS (US Sales Only), PC A06/MF A01	DE84780621	MN -34D	9:50823
9065	NTIS (US Sales Only), PC A10/MF A01	DE84780622	MN -34A	9:50288
9067	NTIS (US Sales Only), PC A09/MF A01	DE85780058	MN -48	9:50593
9068	NTIS (US Sales Only), PC A11/MF A01	DE85780060	MN -23	9:50613
9069	NTIS (US Sales Only), PC A07/MF A01	DE85780057	MN -51	9:50659
INIS-SU-				
216	NTIS (US Sales Only), PC A10/MF A01	DE84780550	MN -34A	9:50760
INPE-				
3103-PRE/ 502	*See* N-84-26551			9:50688
ISAS-				
47-83/ EP	NTIS (US Sales Only), PC A02/MF A01	DE84703110	MN -34B	9:50672
ISH-				
28	Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahlenhygiene			9:50560
JAERI-M-				
83-221	*See* NEANDC(J)-95-U	DE84900731	MN -34C	9:50844
84-163	*See* NEANDC(J)-104/U	TI84901850	ND -34C	9:50845
84-165	*See* NEANDC(J)-105/U	TI84901864	ND -34C	9:50846
JPL-				
400-205	*See* N-84-25588			9:51045
5101-232	*See* N-84-22008			9:49619
5105-121	*See* N-84-22010			9:49706
5220-21	*See* N-84-22009			9:49654
JPL-PUB-				
83-40A	*See* N-84-22007			9:49941
83-59	*See* N-84-22006			9:49940
83-66	*See* N-84-22001			9:49938
83-67	*See* N-84-22005			9:49939
83-74	*See* N-84-22003			9:50052
83-76	*See* N-84-22002			9:50423
83-92	*See* N-84-22004			9:49705
83-101	*See* DOE/JPL-1060-66	DE85000337	STD -62b	9:49663
84-2	*See* DOE/JPL-1012-94	DE85000334	STD -63b	9:49607
84-36	*See* DOE/ET/20356-15	DE85000329	STD -63	9:49602
84-39	*See* DOE/JPL-1060-74	DE85000323	STD -62b	9:49664
84-46	*See* DOE/JPL-1060-75	DE85000322	STD -62b	9:49665
84-53	*See* DOE/JPL/1060-76	DE85000352	STD -62b	9:49666
Juel-				
1872	NTIS (US Sales Only), PC A06/MF A01	DE84751528	MN -77	9:49860
1888	NTIS (US Sales Only), PC A05/MF A01	DE84751924	MN -80	9:49800
1889	NTIS (US Sales Only), PC A03/MF A01	DE84751919	MN -80	9:49837
1891	NTIS (US Sales Only), PC A06/MF A01; 1	DE84752112	MN -38	9:50289
1893	NTIS (US Sales Only), PC A04/MF A01	DE84752159	MN -77	9:49780
1897	NTIS (US Sales Only), PC A06/MF A01	DE84752160	MN -48	9:50614
1899	NTIS (US Sales Only), PC A03/MF A01	DE84752162	MN -86	9:49518
Juel-Spez-				
208	NTIS (US Sales Only), PC A06/MF A01	DE84751527	MN -32	9:51055
216	NTIS (US Sales Only), PC A09/MF A01	DE84751521	MN -16	9:49569
223	NTIS (US Sales Only), PC A04/MF A01	DE84751928	MN -02	9:49794
230	NTIS (US Sales Only), PC A03/MF A01	DE84751819	MN -15	9:49570
235	NTIS (US Sales Only), PC A05/MF A01	DE84752163	MN -77	9:49861
KFK-				
3470	NTIS (US Sales Only), PC A13/MF A01	DE84751913	MN -80	9:49862
3607-B	NTIS (US Sales Only), PC A03/MF A01	DE84752165	MN -78	9:49871
3615	NTIS (US Sales Only), PC A02/MF A01	DE84751515	MN -25	9:50129
3617	NTIS (US Sales Only), PC A03/MF A01	DE84751917	MN -86	9:49519
3636	NTIS (US Sales Only), PC A04/MF A01	DE84751523	MN -80	9:49872
3654	NTIS (US Sales Only), PC A14/MF A01	DE84751517	MN -80	9:49873
3660	NTIS (US Sales Only), PC A11/MF A01; 1	DE85750064	MN -25	9:50161
3663	Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)			9:49874
3665	NTIS (US Sales Only), PC A02/MF A01	DE84751916	MN -22	9:49510
3667	NTIS (US Sales Only), PC A07/MF A01	DE84751522	MN -80	9:50401
3670	NTIS (US Sales Only), PC A12/MF A01	DE84751925	MN -80	9:49875
3671	NTIS (US Sales Only), PC A06/MF A01	DE84751922	MN -79	9:49882
3673	NTIS (US Sales Only), PC A09/MF A01	DE84751915	MN -02	9:49521
3680	NTIS (US Sales Only), PC A25/MF A01	DE84752167	MN -20	9:51033
3705	NTIS (US Sales Only), PC A06/MF A01	DE84752169	MN -20	9:51034
3707	NTIS (US Sales Only), PC A07/MF A01	DE84751923	MN -78	9:49883
3719	NTIS (US Sales Only), PC A04/MF A01	DE84752155	MN -80	9:49884
3726	NTIS (US Sales Only), PC A06/MF A01	DE84751930	MN -41	9:50480
3732	NTIS (US Sales Only), PC A05/MF A01	DE84752164	MN -22	9:49511
3735	NTIS (US Sales Only), PC A02/MF A01	DE84752161	MN -34C	9:50865

Report Number	Availability Source	File Number	Distribution Category	Abstract Number
KFK-tr-				
687	Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Stabsabteilung Internationale Beziehungen			9:50344
KFKI-				
1983-100	NTIS (US Sales Only), PC A02/MF A01	DE84703108	MN -20	9:51008
1983-103	NTIS (US Sales Only), PC A04/MF A01	DE84703091	MN -34D	9:50963
1983-105	NTIS (US Sales Only), PC A02/MF A01	DE84703097	MN -34D	9:50964
1983-106	NTIS (US Sales Only), PC A02/MF A01	DE84703106	MN -34A	9:50201
1983-109	NTIS (US Sales Only), PC A03/MF A01	DE84703109	MN -34B	9:50673
1983-111	NTIS (US Sales Only), PC A03/MF A01	DE84703105	MN -34A	9:50131
1983-115	NTIS (US Sales Only), PC A02/MF A01	DE84703098	MN -34D	9:50965
1983-116	NTIS (US Sales Only), PC A04/MF A01	DE84703099	MN -34D	9:50966
1983-127	NTIS (US Sales Only), PC A03/MF A01	DE84703156	MN -78	9:49777
1983-128	NTIS (US Sales Only), PC A02/MF A01	DE84703116	MN -34C	9:50913
1983-131	NTIS (US Sales Only), PC A02/MF A01	DE84703117	MN -34C	9:50914
KGI-				
064	*See* N-84-25585			9:50683
KHM-TR-				
72	NTIS (US Sales Only), PC A08/MF A01; 1	DE84751662	MN -90	9:49748
75	NTIS (US Sales Only), PC A09/MF A01; 1	DE84751660	MN -90i	9:49406
76	NTIS (US Sales Only), PC A05/MF A01; 1	DE84751665	MN -90	9:50530
98	NTIS (US Sales Only), PC A06/MF A01; 1	DE84751663	MN -90i	9:49396
99	NTIS (US Sales Only), PC A06/MF A01; 1	DE84751664	MN -90i	9:49397
105	NTIS (US Sales Only), PC A18/MF A01; 1	DE84751661	MN -90i	9:49398
KTH-NEL-				
33(Vol.1,2)	NTIS (US Sales Only), PC A17/MF A01	DE84703151	MN -80	9:49885
KVB-				
13-45400-1289	*See* PB-84-215425			9:50060
KY/L-				
1328	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002073	MN -41	9:49565
LA-				
10013-MS	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001525	STD -4	9:50290
10069-PR	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84016000	STD -34C	9:50824
10080-C	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE84014134	STD -34	9:50446
10161-MS	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001513	STD -90i	9:49407
10215-MS	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001520	STD -25	9:50414
LA-tr-				
84-30	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002058	MN -66a	9:49722
84-42	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85000239	MN -25	9:50150
LA-UR-				
84-1831	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013897	MN -25	9:50395
84-2727	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84016796	MN -90i	9:49757
84-2750	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016778	MN -34B	9:50967
84-2767	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002013	MN -34C	9:50902
84-2773	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002014	MN -34D	9:50968
84-2815	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002020	MN -41	9:49932
84-2906	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002024	MN -34	9:50481
84-2927	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002039	MN -48	9:50599
84-2936	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002038	MN -25	9:50174
84-2938	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002040	MN -34D	9:50915
84-2943	NTIS, PC A03/MF A01 (GPO Dep.)	DE85002035	MN -34A	9:50498
84-2953	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002036	MN -78	9:49886
84-2989	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002030	MN -34B	9:50674
84-2994	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002033	MN -34	9:50202
84-3001	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002032	MN -25	9:50132
84-3007	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002043	MN -28	9:50447
84-3015	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002042	MN -37	9:50499
84-3022	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002046	MN -34C	9:50905
84-3023	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000938	MN -34C	9:50916
84-3028	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002045	MN -28	9:49572
84-3043	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002048	MN -28	9:50463
84-3044	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002047	MN -28	9:50448
LBL-				
16518	NTIS, PC A04/MF A01 (GPO Dep.)	DE85001418	MN -92a	9:49477
16840	NTIS, PC A10/MF A01; 1 (GPO Dep.)	DE84010489	STD -48	9:50594
17364	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85000700	MN -95d	9:49994
17827	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001396	STD -28	9:50743
17954	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002065	MN -25	9:50162
17967	NTIS, PC A02/MF A01 (GPO Dep.)	DE84015977	MN -95d	9:49995
17994	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85000319	MN -95d	9:49996
18011	NTIS, PC A04/MF A01 (GPO Dep.)	DE84016879	MN -34A	9:50744
18027	NTIS, PC A04/MF A01 (GPO Dep.)	DE85000708	MN -25	9:50092
18080	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002007	MN -34A	9:50745
18114	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000712	MN -95d	9:49997
18183	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85000392	MN -4	9:50301
18193	NTIS, PC A07/MF A01 (GPO Dep.)	DE85000393	MN -34	9:50955
18195	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000702	MN -38	9:50372
18216	NTIS, PC A04/MF A01 (GPO Dep.)	DE85001417	MN -34A	9:50746
18217	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE85000391	MN -32	9:50756
18246	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85000703	MN -32	9:51056
18259	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002067	MN -37	9:50482
18271	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002069	MN -34B	9:50675
18275	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002071	MN -34	9:50747

Report Number	Availability Source	File Number	Distribution Category	Abstract Number
18276	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE85002070	MN -34	9:50203
18290	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000713	MN -4	9:50335
18292	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE85002006	MN -25	9:50133
18297	NTIS, PC A11/MF A01 (GPO Dep.)	DE85001866	MN -4	9:50302
18307	*See* LA-UR-84-3022	DE85002046	MN -34C	9:50905
18316	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85000698	MN -34C	9:50867
18362	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85000701	MN -38	9:50373
LBL-PUB-				
3044	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85002001	MN -94	9:49908
3045	NTIS, PC A11/MF A01; 1 (GPO Dep.)	DE85000389	MN -32	9:51057
LRAP-				
18	NTIS (US Sales Only), PC A02/MF A01; 1	DE84751666	MN -96	9:50077
ME-				
201/ 81	*See* OEFZS-4058	DE84703104	MN -34A	9:50749
MG-				
84/ 1	NTIS (US Sales Only), PC A06/MF A01	DE84703179	MN -70	9:49551
MHSMP-				
84-36	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001805	STD -35	9:50505
MLM-				
3156(OP)	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002117	MN -25	9:50163
3180(OP)	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016938	MN -45	9:50419
MRC-R-				
770	*See* AD-A-141339/2			9:50510
MTI-				
84TR38	*See* PB-84-214378			9:50058
MTR-				
80W76-03	NTIS, PC A12/MF A01 (GPO Dep.)	DE84012982	MN -90f	9:49749
N-				
84-20551	NTIS, PC A14/MF A01			9:50356
84-20843	NTIS, PC A02/MF A01			9:50748
84-20844	NTIS, PC A03/MF A01			9:50513
84-20847	NTIS, PC A02/MF A01			9:50475
84-20858	NTIS, PC A02/MF A01			9:50204
84-20877	NTIS, PC A02/MF A01			9:49762
84-20878	NTIS, PC A02/MF A01			9:50078
84-20913	NTIS, PC A03/MF A01			9:50562
84-20914	Univ. Microfilms Order No. DA8325947			9:49612
84-20916	NTIS, PC A02/MF A01			9:49613
84-20982	NTIS, PC A02/MF A01			9:50514
84-21903	NTIS, PC A06/MF A01			9:49737
84-21905	NTIS, PC A02/MF A01			9:50079
84-21977	NTIS, PC A10/MF A01			9:49918
84-21983	NTIS, PC A18/MF A01			9:49614
84-21986	NTIS, PC A18/MF A01			9:49615
84-21990	NTIS, PC A18/MF A01			9:49616
84-21992	NTIS, PC A18/MF A01			9:49617
84-21994	NTIS, PC A18/MF A01			9:50421
84-21997	NTIS, PC A18/MF A01			9:50422
84-21998	NTIS, PC A18/MF A01			9:49618
84-22001	NTIS, PC A07/MF A01			9:49938
84-22002	NTIS, PC A03/MF A01			9:50423
84-22003	NTIS, PC A08/MF A01			9:50052
84-22004	NTIS, PC A02/MF A01			9:49705
84-22005	NTIS, PC A02/MF A01			9:49939
84-22006	NTIS, PC A03/MF A01			9:49940
84-22007	NTIS, PC A04/MF A01			9:49941
84-22008	NTIS, PC A04/MF A01			9:49619
84-22009	NTIS, PC A09/MF A01			9:49654
84-22010	NTIS, PC A05/MF A01			9:49706
84-22025	NTIS, PC A05/MF A01			9:49620
84-24661	NTIS, PC A09/MF A01			9:50676
84-24662	NTIS, PC A09/MF A01			9:50677
84-24663	NTIS, PC A09/MF A01			9:50715
84-24664	NTIS, PC A09/MF A01			9:50678
84-24665	NTIS, PC A09/MF A01			9:50679
84-24670	NTIS, PC A09/MF A01			9:50680
84-24684	NTIS, PC A09/MF A01			9:50681
84-25583	NTIS, PC A03/MF A01			9:50682
84-25585	NTIS, PC A02/MF A01			9:50683
84-25587	NTIS, PC A06/MF A01			9:50684
84-25588	NTIS, PC A03/MF A01			9:51045
84-26510	NTIS, PC A08/MF A01			9:50685
84-26512	NTIS, PC A08/MF A01			9:50716
84-26515	NTIS, PC A08/MF A01			9:50686
84-26550	NTIS, PC A03/MF A01			9:50687
84-26551	NTIS, PC A02/MF A01			9:50688
84-26554	NTIS, PC A03/MF A01			9:50689
84-26557	NTIS, PC A02/MF A01			9:50690
84-26558	NTIS, PC A03/MF A01			9:50691
84-26559	NTIS, PC A03/MF A01			9:50692
84-26560	NTIS, PC A02/MF A01			9:50693
84-26561	NTIS, PC A04/MF A01			9:50694
84-26562	NTIS, PC A04/MF A01			9:50695
8424519	NTIS, PC A08/MF A01			9:50696

Report Number	Availability Source	File Number	Distribution Category	Abstract Number
8424520	NTIS, PC A09/MF A01			9:50697
8427656	NTIS, PC A02/MF A01			9:50698
8427657	NTIS, PC A02/MF A01			9:50699
8427658	NTIS, PC A03/MF A01			9:50700
8427659	NTIS, PC A02/MF A01			9:50701
8428721	NTIS, PC A02/MF A01			9:50702
NASA-CR-				
172806	*See* N-84-25588			9:51045
173394	*See* N-84-21903			9:49737
173453	*See* N-84-22006			9:49940
173454	*See* N-84-22007			9:49941
173456	*See* N-84-22001			9:49938
173458	*See* N-84-22009			9:49654
173460	*See* N-84-22008			9:49619
173462	*See* N-84-22010			9:49706
173467	*See* N-84-22005			9:49939
173469	*See* N-84-22003			9:50052
173470	*See* N-84-22004			9:49705
173472	*See* N-84-22002			9:50423
173473	*See* N-84-21905			9:50079
173545	*See* N-84-26550			9:50687
173561	*See* N-84-25587			9:50684
173568	*See* N-84-26559			9:50692
173591	*See* N-84-26558			9:50691
173606	*See* N-84-26557			9:50690
173629	*See* N-8427656			9:50698
173635	*See* N-8427657			9:50699
173650	*See* N-8427658			9:50700
174720	*See* DOE/NASA-0017-2	DE85001154	STD -97d	9:49965
175248	*See* N-8428721			9:50702
175433	*See* N-84-20844			9:50513
175442	*See* N-84-20843			9:50748
NASA-SP-				
7043(40)	*See* N-84-21977			9:49918
NASA-TM-				
83604	*See* N-84-20858			9:50204
83612	*See* N-84-20916			9:49613
85447	*See* N-84-26562			9:50695
86074	*See* N-8427659			9:50701
86102	*See* N-8424519			9:50696
86109	*See* N-84-26560			9:50693
86110	*See* N-84-26561			9:50694
86112	*See* N-84-25583			9:50682
86120	*See* N-84-26554			9:50689
NASA-TP-				
2243	*See* N-84-20878			9:50078
2325	*See* N-8424520			9:50697
NBS-BSS-				
137	*See* PB-84-203348			9:49689
NEANDC(E)-				
230-L	NTIS (US Sales Only), PC A13/MF A01	DE84703118	MN -34C	9:50827
242-U(Vol.5)	NTIS (US Sales Only), PC A05/MF A01	DE84703122	MN -34C	9:50825
NEANDC(J)-				
95-U	NTIS (US Sales Only), PC A04/MF A01	DE84900731	MN -34C	9:50844
104/ U	Information Section, Div. of Technical Information, Japan Atomic Energy Research Inst., Tokai-Mura, Naka-gun, Ibaraki-ken 319-11, Japan	TI84901850	ND -34C	9:50845
105/ U	Information Section, Div. of Technical Information, Japan Atomic Energy Research Inst., Tokai-mura, Naka-gun, Ibaraki-ken 319-11, Japan	TI84901864	ND -34C	9:50846
NHA-				
5492-82/ 09	Canada Mortgage and Housing Corp., Ottawa, Ontario, $6.00	TI84900991	ND -95d	9:49998
NIPER-				
132-PPS-83/ 5	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001685	MN -92	9:49472
NISK/R-				
5/ 83	NTIS (US Sales Only), PC A04/MF A01; 1	DE84751646	MN -13	9:49925
NMAB-				
390	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE85000733	MN -94c	9:49913
NMERDI-				
2-67-1135/ 11	NTIS, PC A05/MF A01 (GPO Dep.)	DE85002049	MN -59b	9:49687
NP-				
4751639	NTIS (US Sales Only), PC A04/MF A01; 1	DE84751639	MN -97e	9:49596
4751642	NTIS (US Sales Only), PC A06/MF A01; 1	DE84751642	MN -95e	9:50440
4751650	NTIS (US Sales Only), PC A11/MF A01; 1	DE84751650	MN -92a	9:49443
4770470	NTIS (US Sales Only), PC A03/MF A01; 1	DE84770470	MN -13	9:49950
4770473	NTIS (US Sales Only), PC A09/MF A01; 1	DE84770473	MN -4	9:49579
4770474	NTIS (US Sales Only), PC A09/MF A01; 1	DE84770474	MN -95	9:49999
4770475	NTIS (US Sales Only), PC A10/MF A01; 1	DE84770475	MN -38	9:50402
4770476	NTIS (US Sales Only), PC A10/MF A01; 1	DE84770476	MN -95	9:50053
4770515	NTIS (US Sales Only), PC A13/MF A01; 1	DE84770515	MN -38	9:50403
4770516	NTIS (US Sales Only), PC A06/MF A01; 1	DE84770516	MN -25	9:50205
4770517	NTIS (US Sales Only), PC A07/MF A01; 1	DE84770517	MN -38	9:50404
4770518	NTIS (US Sales Only), PC A07/MF A01; 1	DE84770518	MN -4	9:49574

Report Number	Availability Source	File Number	Distribution Category	Abstract Number
4770519	NTIS (US Sales Only), PC A05/MF A01; 1	DE84770519	MN -25	9:50134
4770520	NTIS (US Sales Only), PC A05/MF A01; 1	DE84770520	MN -25	9:50135
4770521	NTIS (US Sales Only), PC A11/MF A01; 1	DE84770521	MN -94cc	9:49914
4770522	NTIS (US Sales Only), PC A06/MF A01; 1	DE84770522	MN -96	9:50087
4770523	NTIS (US Sales Only), PC A08/MF A01; 1	DE84770523	MN -96	9:50080
4770524	NTIS (US Sales Only), PC A09/MF A01; 1	DE84770524	MN -96	9:50081
4770525	NTIS (US Sales Only), PC A07/MF A01; 1	DE84770525	MN -25	9:50164
4770526	NTIS (US Sales Only), PC A07/MF A01; 1	DE84770526	MN -25	9:50136
4770527	NTIS (US Sales Only), PC A07/MF A01; 1	DE84770527	MN -25	9:50137
4770529	NTIS (US Sales Only), PC A07/MF A01; 1	DE84770529	MN -95	9:50405
4770530	NTIS (US Sales Only), PC A09/MF A01; 1	DE84770530	MN -96	9:50085
4770531	NTIS (US Sales Only), PC A11/MF A01; 1	DE84770531	MN -96	9:50082
4770532	NTIS (US Sales Only), PC A10/MF A01; 1	DE84770532	MN -97	9:49760
4901771	Dept. of Development, Div. of Energy, PO Box 1001, Columbus, OH 43216	TI84901771	MN -95f	9:50000
4901773	Dept. of Development, Div. of Energy, Box 1001, Columbus, OH 43216	TI84901773	MN -61A	9:49584
4901778	Dept. of Development, Div. of Energy, Box 1001, Columbus, OH 43216	TI84901778	MN -95f	9:50054
4901786	Dept. of Development, Div. of Energy, P.O. Box 1001, Columbus, OH 43216	TI84901786	MN -95d	9:50001
4901788	Dept. of Development, Div. of Energy, P.O. Box 1001, Columbus, OH 43216	TI84901788	MN -95d	9:50002
4901791	Dept. of Development, Div. of Energy, P.O. Box 1001, Columbus, OH 43216	TI84901791	MN -90	9:49433
4901794	Dept. of Development, Div. of Energy, P.O. Box 1001, Columbus, OH 43216	TI84901794	MN -95f	9:50055
4901795	Dept. of Development, Div. of Energy, P.O. Box 1001, Columbus, OH 43216	TI84901795	MN -95d	9:50056
4901797	Dept. of Development, Div. of Energy, P.O. Box 1001, Columbus, OH 43216	TI84901797	MN -90	9:49423
4901865	North Dakota Geological Survey, University Station, Grand Forks, ND 58202	TI84901865	MN -11	9:50660
5900029	Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062	TI85900029	MN -63	9:49621
5900034	NTIS, PC A04/MF A01; 1	DE85900034	MN -41	9:50652
5900040	Dept. of Conservation, 701 Broadway, Nashville, TN 37203, $2.00	TI85900040	MN -90	9:49408
5900049	NERC, Research Park, Terhune Road, Princeton, NJ 08540	TI85900049	MN -97	9:49744
5900053	New Mexico Bureau of Mines and Mineral Resources, Socarro, NM 87801	TI85900053	MN -92a	9:49475
NRL-MR-				
5305	*See* AD-A-141244/4			9:50818
5321	*See* AD-A-141241/0			9:50450
5328	*See* AD-A-141277/4			9:50451
NSF-				
81-305	National Science Foundation, Washington, DC 20550	TI84901910	MN -13	9:49926
NUREG-				
0020-Vol.8-No.8	NTIS, PC A17/MF A01 - GPO*	TI85900257	MN -78	9:49763
0420-Suppl.7	NTIS, PC A08/MF A01 - GPO* $5.50	TI85900062	MN -78	9:49887
0750-Vol.19-No.5	NTIS, PC A09/MF A01 - GPO*	TI85900022	MN -78	9:49785
0750-Vol.19-No.6	NTIS, PC A13/MF A01 - GPO*	TI85900266	MN -80	9:49786
1026-Final	NTIS, PC A12/MF A01 - GPO* $7.00	TI84901549	MN -11	9:50586
1029	NTIS, PC A05/MF A01 - GPO* $4.50	TI85900038	MN -41	9:50615
1083	NTIS, PC A04/MF A01 - GPO* $4.50	TI85900260	MN -80	9:49888
NUREG/BR-				
0051-Vol.6-No.2	NTIS, PC A04/MF A01 - GPO*	TI85900261	MN -78	9:49764
NUREG/CR-				
2576	NTIS, PC A12/MF A01 - GPO* $7.50	TI85900036	MN -78	9:49889
3663-Vol.2	NTIS, PC A05/MF A01 - GPO $4.50	TI84013378	MN -78	9:49890
3665-Exec.Summ.	NTIS, PC A02/MF A01 - GPO* $3.00	TI85900068	MN -78	9:49891
3765	NTIS, PC A03/MF A01 - GPO	TI84016795	MN -79	9:49892
3786	NTIS, PC A04/MF A01 - GPO	TI85000209	MN -80	9:49827
3813	NTIS, PC A03/MF A01 - GPO	TI84016805	MN -78	9:49893
3824	NTIS, PC A07/MF A01 - GPO* $5.50	TI85900039	MN -78	9:49765
3899	NTIS, PC A02/MF A01 - GPO* $3.25	TI85900021	MN -78	9:49787
3907	NTIS, PC A05/MF A01 - GPO $4.75	TI85002085	MN -80	9:49816
3988	NTIS, PC A18/MF A01 - GPO* $8.50	TI85900008	MN -78	9:49894
4007	NTIS, PC A08/MF A01 - GPO* $5.50	TI85900256	MN -11	9:50540
NZERDC-P-				
74	NTIS (US Sales Only), PC A04/MF A01; 1	DE85900108	MN -95d	9:50003
75	NTIS (US Sales Only), PC A08/MF A01; 1	DE85900112	MN -61	9:49622
76	NTIS (US Sales Only), PC A09/MF A01; 1	DE85900111	MN -95d	9:50004
OCS/MMS-				
84-0030	OCS, Information Program, 12203 Sunrise Valley Drive, MS 640, Reston, VA 22091	TI84901875	MN -92	9:49449
OEFZS-				
4050	NTIS (US Sales Only), PC A03/MF A01	DE84703162	MN -37	9:50291
4058	NTIS (US Sales Only), PC A02/MF A01	DE84703104	MN -34A	9:50749
4165	NTIS (US Sales Only), PC A03/MF A01	DE84703127	MN -4	9:50347
4167	NTIS (US Sales Only), PC A04/MF A01	DE84703164	MN -83	9:49552
4187	NTIS (US Sales Only), PC A02/MF A01	DE84703133	MN -34B	9:50541
4195	NTIS (US Sales Only), PC A03/MF A01	DE84703128	MN -4	9:50348

Report Number	Availability Source	File Number	Distribution Category	Abstract Number
4249	NTIS (US Sales Only), PC A04/MF A01	DE84703165	MN -70B	9:49553
4265	NTIS (US Sales Only), PC A03/MF A01	DE84703145	MN -23	9:49573
4268	NTIS (US Sales Only), PC A02/MF A01	DE84703141	MN -41	9:50653
4269	NTIS (US Sales Only), PC A02/MF A01	DE84703139	MN -41	9:50940
4272	NTIS (US Sales Only), PC A04/MF A01	DE84703148	MN -80	9:49895
4273	NTIS (US Sales Only), PC A02/MF A01	DE84703182	MN -2	9:50257
4274	NTIS (US Sales Only), PC A03/MF A01	DE84703144	MN -23	9:50483
4275	NTIS (US Sales Only), PC A02/MF A01	DE84703152	MN -80	9:49750
4276	NTIS (US Sales Only), PC A04/MF A01	DE84703154	MN -80	9:49896
4277	NTIS (US Sales Only), PC A02/MF A01	DE84703142	MN -41	9:50057
ORNL-				
5992	NTIS, PC A03/MF A01 (GPO Dep.)	DE85001493	STD -4	9:50350
6066	NTIS, PC A07/MF A01 (GPO Dep.)	DE85000483	MN -96	9:50032
6084	NTIS, PC A06/MF A01 (GPO Dep.)	DE85001500	STD -25	9:50093
ORNL/CSD/TM-				
210	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE85001491	MN -32	9:49801
ORNL/FMP-				
84/ 3	NTIS, PC A22/MF A01; 1 (GPO Dep.)	DE85000475	MN -90	9:50094
ORNL/Sub-				
79-21453/ 18	NTIS, PC A03/MF A01 (GPO Dep.)	DE85000340	MN -20a	9:51035
80-7948/ 1	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE85001735	MN -95d	9:50005
81-22201/ 2	NTIS, PC A03/MF A01 (GPO Dep.)	DE85001736	MN -95d	9:50006
ORNL/TM-				
8835	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85001495	STD -90i	9:49399
8946	NTIS, PC A05/MF A01 (GPO Dep.)	DE85001731	STD -90d	9:49360
9038	NTIS, PC A16/MF A01; 1 (GPO Dep.)	DE84017642	STD -97c	9:50374
9096	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE85001694	MN -41	9:50636
9153	NTIS, PC A03/MF A01 (GPO Dep.)	DE85001692	MN -37	9:50484
9165	NTIS, PC A04/MF A01 (GPO Dep.)	DE85001733	MN -97e	9:49599
9204	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85001498	MN -98B	9:49461
9250	NTIS, PC A04/MF A01 (GPO Dep.)	DE85001691	MN -32	9:51058
9358	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001700	MN -80	9:49838
ORNL-tr-				
5149	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016130	MN -95d	9:50025
5150	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016098	MN -95d	9:50026
5162	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE85000088	MN -86	9:49522
ORO-				
3346-257	*See* DOE/ER/03346-257	DE85001336	MN -34C	9:50869
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PB-				
84-129766	*See* N-84-20913			9:50562
84-182989	NTIS PC E06/MF E01			9:50570
84-184209	NTIS, PC A02/MF A01			9:50485
84-194091	NTIS, PC A03/MF A01			9:50571
84-194604	NTIS, PC A02/MF A01			9:50572
84-194851	NTIS, PC A08/MF A01			9:50579
84-196732	NTIS, PC A11/MF A01			9:50551

Report Number	Availability Source	File Number	Distribution Category	Abstract Number
84-198621	NTIS, PC A06/MF A01			9:50552
84-198639	NTIS, PC A13/MF A01			9:50573
84-198746	NTIS, PC A07/MF A01			9:50531
84-199553	NTIS, PC A08/MF A01			9:49761
84-199660	NTIS, PC A02/MF A01			9:50532
84-200575	NTIS, PC A08/MF A01			9:49623
84-201607	NTIS, PC A05/MF A01			9:50580
84-202001	NTIS PC E04/MF E04			9:49688
84-202365	NTIS PC E04/MF E04			9:49462
84-202431	NTIS PC E03/MF E03			9:49463
84-202480	NTIS, PC A04/MF A01			9:49361
84-203223	NTIS PC E03/MF E03			9:49464
84-203231	NTIS PC E04/MF E04			9:49465
84-203348	NTIS, PC A03/MF A01			9:49689
84-205368	NTIS PC E04/MF E04			9:49466
84-205376	NTIS PC E05/MF E05			9:50007
84-205418	NTIS PC E04/MF E04			9:49732
84-206515	NTIS, PC A09/MF A01			9:50533
84-207307	NTIS, PC A03/MF A01			9:50008
84-207679	NTIS, PC A04/MF A01			9:50438
84-209097	NTIS, PC A02/MF A01			9:50432
84-210129	NTIS, PC A04/MF A01			9:50433
84-210558	NTIS PC E04/MF E01			9:50009
84-210566	NTIS PC E04/MF E01			9:50010
84-210574	NTIS PC E05/MF E01			9:50011
84-210590	NTIS PC E04/MF E01			9:50012
84-210608	NTIS PC E03/MF E01			9:50013
84-210616	NTIS PC E03/MF E01			9:49490
84-210772	NTIS PC E04/MF E01			9:50014
84-211259	NTIS, PC A02/MF A01			9:50434
84-211283	NTIS, PC A05/MF A01			9:49505
84-211663	NTIS PC E06/MF E06			9:49591
84-211747	NTIS PC E07/MF E07			9:49575
84-212091	NTIS, PC A02/MF A01			9:50015
84-212455	NTIS, PC A02/MF A01			9:50016
84-212471	NTIS, PC A02/MF A01			9:50017
84-212497	NTIS PC E12/MF E12			9:49909
84-212554	NTIS PC E08/MF E08			9:49724
84-212711	NTIS, PC A11/MF A01			9:50664
84-212752	NTIS, PC A17/MF A01			9:50553
84-213271	NTIS PC E08/MF E08			9:49731
84-213511	NTIS, PC A03/MF A01			9:49415
84-213735	NTIS, PC A03/MF A01			9:49416
84-214378	NTIS, PC A04/MF A01			9:50058
84-214386	NTIS, PC A03/MF A01			9:50059
84-214790	NTIS PC E03/MF E03			9:49580
84-214956	NTIS PC E05/MF E05			9:49960
84-215052	NTIS, PC A04/MF A01			9:49417
84-215110	NTIS PC E12/MF E12			9:50018
84-215425	NTIS, PC A20/MF A01			9:50060
84-215789	NTIS, PC A05/MF A01			9:49585
84-224336	NTIS, PC A09/MF A01			9:49481
PH-				
351/ 82	*See* OEFZS-4187	DE84703133	MN -34B	9:50541
PINSTECH/NED-				
101	NTIS (US Sales Only), PC A03/MF A01	DE84703180	MN -32	9:49839
104	NTIS (US Sales Only), PC A02/MF A01	DE84703160	MN -80	9:49841
105	NTIS (US Sales Only), PC A03/MF A01	DE84703149	MN -80	9:49781
110	NTIS (US Sales Only), PC A02/MF A01	DE84703161	MN -80	9:49842
PINSTECH/NPD-				
102	NTIS (US Sales Only), PC A02/MF A01	DE84703163	MN -37	9:50500
PINSTECH/RIAD-				
102	NTIS (US Sales Only), PC A03/MF A01	DE84703181	MN -32	9:50351
103	NTIS (US Sales Only), PC A02/MF A01	DE84703131	MN -11	9:50352
104	NTIS (US Sales Only), PC A02/MF A01	DE84703132	MN -11	9:50353
105	NTIS (US Sales Only), PC A02/MF A01	DE84703126	MN -4	9:50668
PNL-				
4198	NTIS, PC A12/MF A01; 1 (GPO Dep.)	DE85001033	MN -41	9:49897
4937	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE85001704	MN -70	9:49554
5143-Vol.1	NTIS, PC A12/MF A01; 1 (GPO Dep.)	DE85000493	MN -95d	9:50019
5143-Vol.2	NTIS, PC A12/MF A01; 1 (GPO Dep.)	DE85000494	MN -95d	9:50020
5143-Vol.3	NTIS, PC A12/MF A01; 1 (GPO Dep.)	DE85000495	MN -95d	9:50021
5143-Vol.4	NTIS, PC A12/MF A01 (GPO Dep.)	DE85000491	MN -95d	9:50022
5178	*See* NUREG/CR-3907	TI85002085	MN -80	9:49816
5244-Vol.1	NTIS, PC A03/MF A01 (GPO Dep.)	DE85001734	MN -95	9:49943
5271	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE85001098	MN -98	9:49952
PNL-SA-				
10761	NTIS, PC A03/MF A01 (GPO Dep.)	DE85000359	MN -25	9:50138
10826	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000374	MN -48	9:50550
11669	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000361	MN -11	9:50542
11884	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000395	MN -94e	9:49904
11908	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85000400	MN -70	9:49555
11931	NTIS, PC A03/MF A01 (GPO Dep.)	DE85000369	MN -37	9:50486

Report Number	Availability Source	File Number	Distribution Category	Abstract Number
11947	NTIS (US Sales Only), PC A02/MF A01; 1 (GPO Dep.)	DE85000373	MN -78	9:49814
12000	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000358	MN -70	9:49556
12004	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000365	MN -15	9:49571
12152	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84008644	MN -11	9:50561
12191	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000399	MN -94e	9:49910
12256	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000355	MN -95f	9:50061
12270	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000371	MN -61D	9:49586
12398	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000398	MN -85	9:49523
12412	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000375	MN -48	9:50637
12426	NTIS (US Sales Only), PC A02/MF A01 (GPO Dep.)	DE85000368	MN -78	9:49898
12442	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85000356	MN -70	9:50667
12456	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85000372	MN -61D	9:49587
12457	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85000397	MN -32	9:51059
12461	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85000370	MN -32	9:50359
12474	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000396	MN -32	9:51060
12522	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85000394	MN -70	9:49557
PWA-				
84/ 83	*See* KFK-3617	DE84751917	MN -86	9:49519
94/ 83	*See* KFK-3673	DE84751915	MN -02	9:49521
R-				
84056	*See* PB-84-214386			9:50059
RAD-				
83-203-001-53-19	*See* PB-84-207679			9:50438
RADC-TR-				
83-273	*See* AD-A-141288/1			9:50476
REG/G-				
1.89-Rev.1	NTIS, PC A02/MF A01 - GPO*	TI84901580	MN -80	9:49788
RF-				
763300/ 714885	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84007896	MN -59b	9:49707
RHO-BW-CR-				
142-P	NTIS, PC A08/MF A01 (GPO Dep.)	DE85000574	MN -70B	9:49558
RISO-M-				
2403	NTIS (US Sales Only), PC A03/MF A01; 1	DE84751634	MN -60	9:49738
2406	NTIS (US Sales Only), PC A03/MF A01; 1	DE84751635	MN -60	9:49739
2419	NTIS (US Sales Only), PC A02/MF A01	DE84751636	MN -60	9:49740
RL-				
83-123	NTIS (US Sales Only), PC A03/MF A01	DE84703114	MN -34D	9:50770
8845	*See* N-84-20877			9:49762
RN-FOP-				
0014	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84017122	MN -33	9:49844
RR-				
1712	*See* BHRA-84/35			9:49409
RS-				
235/ 84	*See* OEFZS-4272	DE84703148	MN -80	9:49895
237/ 84	*See* OEFZS-4275	DE84703152	MN -80	9:49750
238/ 84	*See* OEFZS-4276	DE84703154	MN -80	9:49896
RTI-				
2784/ 01-01F	*See* PB-84-206515			9:50533
SAIC-				
84/ 1317-Exec.Summ.	*See* NUREG/CR-3665-Exec.Summ.	TI85900068	MN -78	9:49891
84/ 1782	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000754	MN -90i	9:49400
SAND-				
83-7035	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE85001125	STD -63a	9:49624
84-0343	NTIS, PC A03/MF A01 (GPO Dep.)	DE85001143	STD -70	9:49559
84-0522C-Rev.	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001447	MN -78	9:49899
84-0556	NTIS, PC A13/MF A01; 1 (GPO Dep.)	DE85001444	MN -63	9:49625
84-0847	NTIS, PC A03/MF A01 (GPO Dep.)	DE85001948	MN -38	9:51061
84-0978	*See* NUREG/CR-3786	TI85000209	MN -80	9:49827
84-1300C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001804	MN -38	9:50139
84-1665C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016722	MN -80	9:49937
84-1738C	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84016723	MN -37	9:50501
84-1806C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016782	MN -38	9:50502
84-7013	NTIS, PC A03/MF A01 (GPO Dep.)	DE85000213	MN -63c	9:49626
84-8175	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85000246	MN -62e	9:49672
84-8177	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002090	MN -62c	9:49673
84-8178	NTIS, PC A03/MF A01 (GPO Dep.)	DE85001589	MN -62c	9:49674
84-8234	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85001585	MN -32	9:50503
SCL-CR-				
67-191	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85001758	MN -38	9:50415
SERI/SP-				
253-2373	NTIS, PC A07/MF A01 (GPO Dep.)	DE84012753	STD -59a	9:49690
SERI/STR-				
211-2393	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013038	STD -63	9:49627
SI-R-				
810220-1	NTIS (US Sales Only), PC A03/MF A01; 1	DE84751652	MN -92a	9:50436
820116-1	NTIS (US Sales Only), PC A04/MF A01; 1	DE84751649	MN -4	9:50319
SL-				
82211-01-Pt.1	NTIS (US Sales Only), PC A04/MF A01; 1	DE84751637	MN -60	9:49741
82211-01-Pt.2	NTIS (US Sales Only), PC A03/MF A01; 1	DE84751638	MN -60	9:49742
SLAC-CN-				
280	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85000461	MN -28	9:50453

Report Number	Availability Source	File Number	Distribution Category	Abstract Number
SLAC-PUB-				
3271	*See* RL-83-123	DE84703114	MN -34D	9:50770
3378	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84017353	MN -25	9:50140
3396	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001560	MN -28	9:50464
3427	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001884	MN -28	9:50454
SLU-ISK-				
153	NTIS (US Sales Only), PC A05/MF A01; 1	DE84751655	MN -13	9:49920
SOL-				
84-6	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85001557	MN -32	9:51062
SOLAR/0011-				
84/ 01	NTIS, PC A10/MF A01; 1 (GPO Dep.)	DE85002140	STD -59a	9:49691
SOLAR/0013-				
84/ 30	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE85001385	STD -59a	9:49692
SOLAR/0015-				
84/ 32	NTIS, PC A11/MF A01; 1 (GPO Dep.)	DE85001297	STD -59a	9:49693
SOLAR/0802-				
84/ 01	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE85001190	STD -59a	9:49694
SOLAR/1024-				
79/ 10	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84017361	MN -59	9:49695
SRD-R-				
281	NTIS (US Sales Only), PC A02/MF A01	DE84703157	MN -78	9:49900
SSRL-				
84/ 05	*See* DOE/SF/00115-T11	DE85002061	MN -25	9:50110
ST-				
103/ 82	*See* OEFZS-4187	DE84703133	MN -34B	9:50541
112/ 84	*See* OEFZS-4268	DE84703141	MN -41	9:50653
113/ 84	*See* OEFZS-4269	DE84703139	MN -41	9:50940
STF-				
28A83007	NTIS (US Sales Only), PC A05/MF A01	DE84751647	MN -92a	9:49450
28A83012	NTIS (US Sales Only), PC A03/MF A01	DE84751648	MN -92a	9:49451
60A82092	NTIS (US Sales Only), PC A05/MF A01; 1	DE84751651	MN -11	9:50581
88A83011	NTIS (US Sales Only), PC A06/MF A01; 1	DE84751644	MN -92a	9:50515
88A83016	NTIS (US Sales Only), PC A07/MF A01; 1	DE84751643	MN -92a	9:50516
88A85024	NTIS (US Sales Only), PC A07/MF A01; 1	DE84751645	MN -92a	9:50517
STI/DOC-				
10/ 237	UNIPUB, P.O. Box 433, Murray Hill Station, New York, NY 10157	TI85900031	ND -2	9:49789
STMPO-				
040	*See* DOE/SF/10501-004	DE84017036	MN -62a	9:49678
491	*See* DOE/SF/10501-014	DE85001376	MN -62	9:49912
494	*See* DOE/SF/10501-017	DE85001374	MN -62	9:49667
496	*See* DOE/SF/10501-019	DE85001375	MN -62	9:49668
536	*See* DOE/SF/10501-059	DE85001370	MN -62	9:49669
538	*See* DOE/SF/10501-060	DE85001380	MN -62	9:49670
964	*See* DOE/SF/10501-063	DE84017040	MN -62a	9:49671
SURRC-				
72/ 84	NTIS (US Sales Only), PC A03/MF A01	DE84703159	MN -80	9:49840
TACOM-TR-				
12909	*See* AD-A-140996/0			9:50068
12910	*See* AD-A-140964/8			9:50067
TB-				
466	*See* PB-84-205418			9:49732
TKK-F-A-				
507	NTIS (US Sales Only), PC A03/MF A01	DE84751670	MN -59a	9:49719
514	NTIS (US Sales Only), PC A02/MF A01	DE84751669	MN -59a	9:49720
TN-				
1652	*See* BHRA-84/43			9:49418
TTC-				
0449-Rev.1	*See* HEDL-7376-Rev.1	DE85000348	MN -70	9:50367
TUHEL-				
83-21	*See* RL-83-123	DE84703114	MN -34D	9:50770
TUM-M-				
8314	Library of Technische Univ. Muenchen (Germany, F.R.). Fakultaet fuer Mathematik und Informatik			9:50969
TVA/ONRED/AWR-				
84/ 21	NTIS, PC A05/MF A01; 1	DE84901970	MN -11	9:50661
TVA/OP/EDT-				
84/ 30	NTIS, PC A04/MF A01; 1	DE84901974	MN -97	9:50504
TVA/PUB-				
84/ 73	NTIS, PC A03/MF A01; 1	DE85900074	MN -98E	9:49958
UBA-FB-				
82-162	Umweltbundesamt, Berlin (Germany, F.R.)			9:50554
UCID-				
20166-Vol.1	NTIS, PC A03/MF A01 (GPO Dep.)	DE85002142	MN -20	9:51036
20173	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000977	MN -90c	9:49362
20175	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000975	MN -34C	9:50465
20211	NTIS, PC A04/MF A01 (GPO Dep.)	DE85001587	MN -11	9:49901
20212-Rev.1	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE85002088	MN -11	9:49902
20217	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001588	MN -4	9:50178
UCRL-				
15563	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE85000999	MN -92a	9:49482
53294-83	NTIS, PC A05/MF A01 (GPO Dep.)	DE84016775	STD -70	9:49560
53500-Vol.2	*See* NUREG/CR-3663-Vol.2	TI84013378	MN -78	9:49890
53564	NTIS, PC A03/MF A01 (GPO Dep.)	DE85001936	STD -2	9:51047

Report Number	Availability Source	File Number	Distribution Category	Abstract Number
53566	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001950	STD -38	9:50512
90160	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85001753	MN -20b	9:51009
90401	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84017452	MN -25	9:50303
90666	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84017568	MN -21	9:51037
91091	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001743	MN -34	9:50893
91098	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001746	MN -34	9:50894
91330	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001752	MN -20f	9:51010
91383	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001741	MN -32	9:51063
91443	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001744	MN -34C	9:50703
91512	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84017570	MN -20	9:51038
91531	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001751	MN -38	9:50382
91565	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001749	MN -4	9:50506
UCRL-Trans-				
11979	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014017	MN -4	9:50328
11989	NTIS, PC A02/MF A01; 1	DE84016066	MN -94cb	9:49916
11996	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84016061	MN -25	9:50170
11997	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016069	MN -25	9:50169
12012	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85000238	MN -80	9:49832
UM-P-				
83/ 58	NTIS (US Sales Only), PC A02/MF A01	DE84703115	MN -34C	9:50903
83/ 78	NTIS (US Sales Only), PC A03/MF A01	DE84703119	MN -34C	9:50856
83/ 79	NTIS (US Sales Only), PC A02/MF A01	DE84703125	MN -34C	9:50877
84/ 3	NTIS (US Sales Only), PC A02/MF A01	DE84703120	MN -34C	9:50917
UNIGRAZ-UTP-				
04-84	NTIS (US Sales Only), PC A03/MF A01	DE84703092	MN -34D	9:50970
05-84	NTIS (US Sales Only), PC A02/MF A01	DE84703093	MN -34D	9:50971
06-84	NTIS (US Sales Only), PC A02/MF A01	DE84703094	MN -34D	9:50972
USGS-OFR-				
84-450	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE85001508	STD -70	9:49561
UWFDM-				
600	*See* KFK-3680	DE84752167	MN -20	9:51033
UWThPh-				
84-05	NTIS (US Sales Only), PC A02/MF A01	DE84703103	MN -34A	9:50750
84-06	NTIS (US Sales Only), PC A03/MF A01	DE84703112	MN -34D	9:50786
84-07	NTIS (US Sales Only), PC A02/MF A01	DE84703111	MN -34B	9:50704
84-08	NTIS (US Sales Only), PC A02/MF A01	DE84703095	MN -34D	9:50973
84-09	NTIS (US Sales Only), PC A02/MF A01	DE84703096	MN -34D	9:50974
84-13	NTIS (US Sales Only), PC A02/MF A01	DE84703090	MN -34D	9:50981
84-14	NTIS (US Sales Only), PC A02/MF A01	DE84703100	MN -34D	9:50975
84-15	NTIS (US Sales Only), PC A03/MF A01	DE84703101	MN -34D	9:50976
84-16	NTIS (US Sales Only), PC A02/MF A01	DE84703113	MN -34D	9:50787
84-17	NTIS (US Sales Only), PC A02/MF A01	DE84703102	MN -34D	9:50705
VERITAS-TN-				
20-002-82	NTIS (US Sales Only), PC A03/MF A01; 1	DE84751653	MN -92a	9:49453
VTT-TIED-				
253	Valtion Teknillinan Tutkimuskeskus, Espoo, Finland	TI84751668	ND -95d	9:50023
WAOENG-				
84-42	NTIS, PC A03/MF A01 (GPO Dep.)	DE85000060	MN -59b	9:49696
WCAP-				
10673	*See* DOE/ET/34014-16	DE85002113	STD -78	9:49770
X-				
601-84-10	*See* N-84-26562			9:50695
Y/DW-				
474	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85001591	MN -38	9:50416
481	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016843	MN -37	9:50417
519	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001592	MN -38	9:50418
ZfK-				
514	NTIS (US Sales Only), PC A02/MF A01	DE84703143	MN -41	9:50543
516	NTIS (US Sales Only), PC A03/MF A01	DE84703147	MN -28	9:50466
522	NTIS (US Sales Only), PC A02/MF A01	DE84703155	MN -80	9:49778

FILE NUMBER CORRELATION

This correlation list is provided for those organizations where document storage is alphanumeric by report number and request may be received by file number. For other information about a document (abstract number, distribution category, availability, and price), please refer to the Report Number Index.

File No.	*Report No.*
DE84000216	DOE/METC—84-6
DE84005177	DOE/TIC—27601
DE84007310	DOE/CA/10004—T1
DE84007896	RF—763300/714885
DE84008176	BNL—34086
DE84008644	PNL-SA—12152
DE84009294	DOE/METC—84-5
DE84010489	LBL—16840
DE84011727	CONF-841122—1
DE84011991	DOE/METC/SP—207
DE84012008	DOE/METC—84-26-Vol.3-Pt.1
DE84012730	DOE/BC/10033—10
DE84012753	SERI/SP—253-2373
DE84012979	CONF-8404135—4
DE84012982	MTR—80W76-03
DE84013038	SERI/STR—211-2393
DE84013656	DOE/TIC—3389-Suppl.1
DE84013897	LA-UR—84-1831
DE84014017	UCRL-Trans—11979
DE84014134	LA—10080-C
DE84014682	CONF-841174—1
DE84015661	DOE/ER/01674—T1
DE84015830	CONF-8408106—1
DE84015843	CONF-841198—1
DE84015844	CONF-8408105—1
DE84015977	LBL—17967
DE84016000	LA—10069-PR
DE84016032	DOE/ER—0144/2
DE84016061	UCRL-Trans—11996
DE84016066	UCRL-Trans—11989
DE84016069	UCRL-Trans—11997
DE84016098	ORNL-tr—5150
DE84016130	ORNL-tr—5149
DE84016291	DOE/ET/15492—T58
DE84016543	DOE/ER/03509—20
DE84016722	SAND—84-1665C
DE84016723	SAND—84-1738C
DE84016775	UCRL—53294-83
DE84016778	LA-UR—84-2750
DE84016782	SAND—84-1806C
DE84016796	LA-UR—84-2727
DE84016843	Y/DW—481
DE84016871	DOE/NBM—4016871
DE84016879	LBL—18011
DE84016938	MLM—3180(OP)
DE84017036	DOE/SF/10501—004
DE84017040	DOE/SF/10501—063
DE84017051	DOE/RA/50156—5
DE84017093	DPST—84-1-6
DE84017121	GEMP—395
DE84017122	RN-FOP—0014
DE84017144	DOE/BP—287
DE84017234	EGG-M—08484
DE84017240	BNL—51542
DE84017248	DOE/ET/10577—T3
DE84017259	FNAL/C—84/73-T
DE84017265	DOE/CS/30012—T1
DE84017297	FE—1765-6
DE84017301	DOE-tr—4017301
DE84017316	CONF-841023—Absts.
DE84017325	DOE/CE/30760—T1
DE84017327	DOE/FE/60181—1642
DE84017329	CONF-8209256—1
DE84017331	CONF-840915—3
DE84017334	DOE/PC/60044—T1
DE84017353	SLAC-PUB—3378
DE84017361	SOLAR/1024—79/10
DE84017396	DOE/PC/50797—T7
DE84017451	DOE/DP/40183—1
DE84017452	UCRL—90401
DE84017474	CONF-840954—6
DE84017492	ANL-HEP-CP—84-62
DE84017494	CONF-8404193—Absts.
DE84017504	CONF-840937—3
DE84017558	DOE/MC/08707—T1
DE84017568	UCRL—90666
DE84017570	UCRL—91512
DE84017599	ANL/PHY—84-2
DE84017621	ANL-Trans—517
DE84017642	ORNL/TM—9038
DE84017643	DOE/NE—0059
DE84703090	UWThPh—84-13
DE84703091	KFKI—1983-103
DE84703092	UNIGRAZ-UTP—04-84
DE84703093	UNIGRAZ-UTP—05-84
DE84703094	UNIGRAZ-UTP—06-84
DE84703095	UWThPh—84-08
DE84703096	UWThPh—84-09
DE84703097	KFKI—1983-105
DE84703098	KFKI—1983-115
DE84703099	KFKI—1983-116
DE84703100	UWThPh—84-14
DE84703101	UWThPh—84-15
DE84703102	UWThPh—84-17
DE84703103	UWThPh—84-05
DE84703104	OEFZS—4058
DE84703105	KFKI—1983-111
DE84703106	KFKI—1983-106
DE84703107	INIS-mf—9063
DE84703108	KFKI—1983-100
DE84703109	KFKI—1983-109
DE84703110	ISAS—47-83/EP
DE84703111	UWThPh—84-07
DE84703112	UWThPh—84-06
DE84703113	UWThPh—84-16
DE84703114	RL—83-123
DE84703115	UM-P—83/58
DE84703116	KFKI—1983-128
DE84703117	KFKI—1983-131
DE84703118	NEANDC(E)—230-L
DE84703119	UM-P—83/78
DE84703120	UM-P—84/3
DE84703122	NEANDC(E)—242-U(Vol.5)
DE84703125	UM-P—83/79
DE84703126	PINSTECH/RIAD—105
DE84703127	OEFZS—4165
DE84703128	OEFZS—4195
DE84703129	CNSNS—0004((Vol.1,2)
DE84703130	GESAMP—19
DE84703131	PINSTECH/RIAD—103
DE84703132	PINSTECH/RIAD—104
DE84703133	OEFZS—4187
DE84703134	ENEA-RT/BIO—82-21
DE84703135	ENEA-RT/PROT—83-9
DE84703136	AERE-G—3002
DE84703137	AERE-G—3011
DE84703138	CEGB-TPRD/B—0426/N84
DE84703139	OEFZS—4269
DE84703140	AERE-M—3376
DE84703141	OEFZS—4268
DE84703142	OEFZS—4277
DE84703143	ZfK—514
DE84703144	OEFZS—4274
DE84703145	OEFZS—4265
DE84703146	FEI—1489
DE84703147	ZfK—516
DE84703148	OEFZS—4272
DE84703149	PINSTECH/NED—105
DE84703150	CEGB-TPRD/B—0345/N83
DE84703151	KTH-NEL—33(Vol.1,2)
DE84703152	OEFZS—4275
DE84703153	FEI—1497
DE84703154	OEFZS—4276
DE84703155	ZfK—522
DE84703156	KFKI—1983-127
DE84703157	SRD-R—281
DE84703158	ECN—155
DE84703159	SURRC—72/84
DE84703160	PINSTECH/NED—104
DE84703161	PINSTECH/NED—110
DE84703162	OEFZS—4050
DE84703163	PINSTECH/NPD—102
DE84703164	OEFZS—4167
DE84703165	OEFZS—4249
DE84703166	AERE-G—2897
DE84703167	AERE-G—2945
DE84703168	AERE-G—2947
DE84703169	AERE-G—2950
DE84703170	AERE-G—2957
DE84703171	AERE-G—2963
DE84703172	AERE-G—2964
DE84703173	AERE-G—2995
DE84703174	ANS-TN-J—249-1
DE84703175	ANS-TN-J—249-3
DE84703176	ANS—318
DE84703177	ANS—332
DE84703178	ENEA-RT/PROT—83-17
DE84703179	MG—84/1
DE84703180	PINSTECH/NED—101
DE84703181	PINSTECH/RIAD—102
DE84703182	OEFZS—4273
DE84751507	HMI-P—27/83-HF(Prepr.)
DE84751508	GSF-R—296
DE84751509	DESY—83-123
DE84751510	DESY—83-124
DE84751511	DESY—83-125
DE84751512	DESY—83-126
DE84751513	DESY—83-127
DE84751514	GSI—83-14
DE84751515	KFK—3615
DE84751517	KFK—3654
DE84751518	GSF-B—1521
DE84751519	GKSS—83/E/67
DE84751520	HMI-B—403
DE84751521	Juel-Spez—216
DE84751522	KFK—3667
DE84751523	KFK—3636
DE84751524	BMI—1984-029
DE84751525	BMI—1983-026
DE84751526	BMI—1983-022
DE84751527	Juel-Spez—208
DE84751528	Juel—1872
DE84751529	DESY—84-001

File No.	Report No.
DE84751530	DESY—84-002
DE84751531	DESY—84-003
DE84751532	DESY—84-004
DE84751533	DESY—84-005
DE84751534	DESY—84-008
DE84751535	DESY—83-128
DE84751536	DESY—83-129
DE84751537	DESY—83-131
DE84751538	GKSS—82/E/57
DE84751539	BMI—1983-021
DE84751634	RISO-M—2403
DE84751635	RISO-M—2406
DE84751636	RISO-M—2419
DE84751637	SL—82211-01-Pt.1
DE84751638	SL—82211-01-Pt.2
DE84751639	NP—4751639
DE84751642	NP—4751642
DE84751643	STF—88A83016
DE84751644	STF—88A83011
DE84751645	STF—88A85024
DE84751646	NISK/R—5/83
DE84751647	STF—28A83007
DE84751648	STF—28A83012
DE84751649	SI-R—820116-1
DE84751650	NP—4751650
DE84751651	STF—60A82092
DE84751652	SI-R—810220-1
DE84751653	VERITAS-TN—20-002-82
DE84751655	SLU-ISK—153
DE84751657	BFR—94:1983
DE84751658	BFR-R—107:1983
DE84751659	BFR-R—103:1983
DE84751660	KHM-TR—75
DE84751661	KHM-TR—105
DE84751662	KHM-TR—72
DE84751663	KHM-TR—98
DE84751664	KHM-TR—99
DE84751665	KHM-TR—76
DE84751666	LRAP—18
DE84751667	FMI-OR—106
DE84751669	TKK-F-A—514
DE84751670	TKK-F-A—507
DE84751819	Juel-Spez—230
DE84751912	GKSS—83/E/75
DE84751913	KFK—3470
DE84751914	GKSS—83/E/74
DE84751915	KFK—3673
DE84751916	KFK—3665
DE84751917	KFK—3617
DE84751918	GKSS—84/E/3
DE84751919	Juel—1889
DE84751920	DESY—84-018
DE84751921	DESY—84-019
DE84751922	KFK—3671
DE84751923	KFK—3707
DE84751924	Juel—1888
DE84751925	KFK—3670
DE84751926	GKSS—83/E/73
DE84751927	GSI—84-3
DE84751928	Juel-Spez—223
DE84751929	IKE—4-113
DE84751930	KFK—3726
DE84752106	BMFT-FB-T—84-089
DE84752107	BMFT-FB-HA—84-021
DE84752108	BMFT-FB-T—84-087
DE84752109	BMFT-FB-W—84-019
DE84752110	GKSS—83/E/42
DE84752111	DFVLR-FB—84-10
DE84752112	Juel—1891
DE84752113	GKSS—84/E/7
DE84752154	BMFT-FB-T—84-059
DE84752155	KFK—3719
DE84752156	GSI—84-25(Prepr.)
DE84752157	GSI—84-24(Prepr.)
DE84752158	BMFT-FB-T—84-117
DE84752159	Juel—1893
DE84752160	Juel—1897
DE84752161	KFK—3735
DE84752162	Juel—1899
DE84752163	Juel-Spez—235
DE84752164	KFK—3732
DE84752165	KFK—3607-B
DE84752166	BONN-HE—84-8
DE84752167	KFK—3680
DE84752168	GSI—84-28(Prepr.)
DE84752169	KFK—3705
DE84752170	GKSS—84/E/6
DE84752171	DESY—84-026
DE84770470	NP—4770470
DE84770472	CONF-8004243—
DE84770473	NP—4770473
DE84770474	NP—4770474
DE84770475	NP—4770475
DE84770476	NP—4770476
DE84770515	NP—4770515
DE84770516	NP—4770516
DE84770517	NP—4770517
DE84770518	NP—4770518
DE84770519	NP—4770519
DE84770520	NP—4770520
DE84770521	NP—4770521
DE84770522	NP—4770522
DE84770523	NP—4770523
DE84770524	NP—4770524
DE84770525	NP—4770525
DE84770526	NP—4770526
DE84770527	NP—4770527
DE84770529	NP—4770529
DE84770530	NP—4770530
DE84770531	NP—4770531
DE84770532	NP—4770532
DE84780548	INIS-mf—9052
DE84780549	INIS-mf—8884
DE84780550	INIS-SU—216
DE84780551	CLM-CD—1983-VOL.1
DE84780552	INIS-mf—9035
DE84780553	IAEA-TECDOC—298
DE84780617	INIS-mf—9038
DE84780621	INIS-mf—9064
DE84780622	INIS-mf—9065
DE84780623	AAEC-LIB/Trans—773
DE84900731	NEANDC(J)—95-U
DE84901524	CONF-711173—Exc.
DE84901725	BG-Trans—5898
DE84901805	CE-Trans—7930
DE84901817	CE-Trans—8006
DE84901822	CE-Trans—7966
DE84901877	FZA—25-123
DE84901905	BM-TPR—115
DE84901970	TVA/ONRED/AWR—84/21
DE84901974	TVA/OP/EDT—84/30
DE85000051	DOE/CS/54237—T1
DE85000057	DOE/ER/10990—T2
DE85000060	WAOENG—84-42
DE85000061	DOE/PE/70025—T1
DE85000062	DOE/ER/40007—26
DE85000063	DOE/ER/10429—T3
DE85000065	CONF-8410148—1
DE85000071	CONF-840901—15
DE85000075	CONF-8409150—1
DE85000080	CONF-841157—4
DE85000081	CONF-840807—5
DE85000083	CONF-8405207—3
DE85000088	ORNL-tr—5162
DE85000093	CONF-8409130—5
DE85000095	CONF-8405113—4
DE85000096	DOE/LLW—6Ta
DE85000099	CONF-8409152—1
DE85000100	CONF-8410147—1
DE85000105	DOE/BC/10321—16
DE85000204	DOE/CE—0101
DE85000207	DOE/ER/70262—T1
DE85000213	SAND—84-7013
DE85000216	DOE/PC/40784—T4
DE85000221	DOE/R4/10161—T1
DE85000223	DOE/R4/10233—T1
DE85000231	BNL—35084
DE85000236	BNL—35250
DE85000238	UCRL-Trans—12012
DE85000239	LA-tr—84-42
DE85000243	CONF-840901—16
DE85000246	SAND—84-8175
DE85000301	DOE/ER/10946—1
DE85000303	DOE/EIA—0130(84/07)
DE85000304	DOE/LLW—6Tf
DE85000305	DOE/EV/03861—49
DE85000311	DOE/R4/10320—T1
DE85000312	DOE/R4/10484—T1
DE85000319	LBL—17994
DE85000322	DOE/JPL—1060-75
DE85000323	DOE/JPL—1060-74
DE85000329	DOE/ET/20356—15
DE85000334	DOE/JPL—1012-94
DE85000337	DOE/JPL—1060-66
DE85000340	ORNL/Sub—79-21453/18
DE85000341	EGG-M—20984
DE85000342	EGG-PBS—6689
DE85000345	DOE/MC/16551—14
DE85000348	HEDL—7376-Rev.1
DE85000350	DOE/ER/10946—2
DE85000352	DOE/JPL/1060—76
DE85000355	PNL-SA—12256
DE85000356	PNL-SA—12442
DE85000358	PNL-SA—12000
DE85000359	PNL-SA—10761
DE85000361	PNL-SA—11669
DE85000365	PNL-SA—12004
DE85000368	PNL-SA—12426
DE85000369	PNL-SA—11931
DE85000370	PNL-SA—12461
DE85000371	PNL-SA—12270
DE85000372	PNL-SA—12456
DE85000373	PNL-SA—11947
DE85000374	PNL-SA—10826
DE85000375	PNL-SA—12412
DE85000377	DOE/R4/10487—T1
DE85000382	BMI/ONWI—540
DE85000389	LBL-PUB—3045
DE85000391	LBL—18217
DE85000392	LBL—18183
DE85000393	LBL—18193
DE85000394	PNL-SA—12522
DE85000395	PNL-SA—11884
DE85000396	PNL-SA—12474
DE85000397	PNL-SA—12457
DE85000398	PNL-SA—12398
DE85000399	PNL-SA—12191
DE85000400	PNL-SA—11908
DE85000459	DOE/RG/03365—T1
DE85000461	SLAC-CN—280
DE85000465	DOE/OR/03054—T22
DE85000472	DOE/EIA—0380(84/07)
DE85000475	ORNL/FMP—84/3
DE85000476	DOE/CS/40091—T7
DE85000477	DOE/CS/40091—T11
DE85000478	DOE/CS/40091—T12
DE85000479	DOE/CE/40654—T1
DE85000480	DOE/CE/40654—T2
DE85000481	DOE/CS/40091—T6
DE85000482	DOE/CS/40091—T9
DE85000483	ORNL—6066
DE85000487	DOE/BP—326
DE85000491	PNL—5143-Vol.4
DE85000492	DOE/NBB—0066
DE85000493	PNL—5143-Vol.1
DE85000494	PNL—5143-Vol.2
DE85000495	PNL—5143-Vol.3
DE85000544	DOE/CS/40091—T5
DE85000545	DOE/CS/40091—T4
DE85000547	DOE/CS/40091—T3
DE85000549	DOE/CS/40091—T8
DE85000567	DOE/ET/13617—T1
DE85000568	DOE/ER/12099—T1
DE85000570	DOE/PC/72007—2
DE85000571	DOE/ER/03077—223
DE85000574	RHO-BW-CR—142-P
DE85000629	DOE/OR/20722—15
DE85000698	LBL—18316
DE85000700	LBL—17364
DE85000701	LBL—18362
DE85000702	LBL—18195
DE85000703	LBL—18246
DE85000705	DOE/PC/40810—10
DE85000708	LBL—18027
DE85000712	LBL—18114
DE85000713	LBL—18290
DE85000716	DP—1674
DE85000718	DOE/EI/02295—T2
DE85000720	DOE/EV/10252—T2
DE85000722	DOE/NBM—5000722
DE85000723	DOE/EV/10472—T5
DE85000724	DOE/EV/10472—T3
DE85000725	DOE/EV/10472—T4
DE85000726	DOE/EV/10472—T6
DE85000727	DOE/EV/10472—T7

File No.	Report No.
DE85000728	DOE/EV/10472—T2
DE85000733	NMAB—390
DE85000738	DOT-I—84-28
DE85000739	DOE/CS/55138—T1
DE85000740	DOT-I—83-32
DE85000754	SAIC—84/1782
DE85000778	ANL/FE—83-23
DE85000788	BMI/ONWI—550
DE85000893	CONF-840387—10
DE85000895	CONF-840311—16
DE85000897	CONF-840417—3
DE85000898	CONF-840417—5
DE85000899	CONF-8404190—3
DE85000902	CONF-8404190—4
DE85000903	CONF-840417—6
DE85000905	CONF-8404170—5
DE85000906	CONF-840417—7
DE85000907	CONF-8403146—4
DE85000912	CONF-8409148—1
DE85000913	CONF-8409153—1
DE85000916	DOE/FE/60181—64
DE85000920	DOE/LLW—6Te
DE85000921	DOE/LLW—33T
DE85000922	DOE/LLW—34T
DE85000923	CONF-8310318—1
DE85000930	CONF-8409107—6
DE85000932	CONF-8409154—1
DE85000933	CONF-8409103—3
DE85000937	DOE/ER/10946—3-Pt.2
DE85000938	LA-UR—84-3023
DE85000943	CONF-8409130—2
DE85000945	CONF-831244—3
DE85000946	CONF-831265—5
DE85000947	CONF-831203—177
DE85000949	CONF-831203—176
DE85000950	CONF-831203—175
DE85000952	CONF-831203—174
DE85000953	CONF-831203—180
DE85000955	CONF-831203—178
DE85000957	CONF-831203—179
DE85000958	DOE/ER/13126—T1
DE85000959	DP—83-125-3
DE85000960	BMI/ONWI—545
DE85000961	CONF-821269—2-Draft
DE85000962	CONF-811236—5
DE85000967	BNL—51778
DE85000968	CONF-8310316—1
DE85000972	CONF-8311198—1
DE85000973	CONF-8403150—1
DE85000974	CONF-8403150—2
DE85000975	UCID—20175
DE85000976	CONF-840387—11
DE85000977	UCID—20173
DE85000981	CONF-840171—1
DE85000983	CONF-840113—9
DE85000985	CONF-840146—2
DE85000988	CONF-840307—49
DE85000989	CONF-840307—48
DE85000999	UCRL—15563
DE85001005	DOE/CS/69095—3
DE85001014	DOE/MC/20693—T10
DE85001017	DOE/EIS—0108D-Vol.2
DE85001018	DOE/EIS—0108D-Vol.1
DE85001033	PNL—4198
DE85001092	CONF-840387—12
DE85001093	DOE/OR/21400—T47
DE85001094	CONF-8403147—1
DE85001095	CONF-8403146—1
DE85001096	CONF-8403148—1
DE85001098	PNL—5271
DE85001100	CONF-8403146—3
DE85001102	CONF-8403146—2
DE85001103	CONF-8404194—1
DE85001104	CONF-840401—1
DE85001106	CONF-8409112—3
DE85001107	DOE/ER/10946—3-Pt.1
DE85001108	CONF-840905—1
DE85001109	CONF-8409146—1
DE85001112	CONF-830942—91-Draft
DE85001122	CONF-8304203—1
DE85001124	CONF-8409149—1
DE85001125	SAND—83-7035
DE85001130	CONF-8409117—3
DE85001133	CONF-8409147—1
DE85001138	DOE/EA—0239
DE85001140	CONF-8309168—7
DE85001141	CONF-8409102—4
DE85001143	SAND—84-0343
DE85001146	DOE/ET/29366—1
DE85001153	DOE/R4/10499—T1
DE85001154	DOE/NASA—0017-2
DE85001156	DOE/PC/60047—T4
DE85001165	DOE/PC/50001—23
DE85001166	DOE/EIA—0109(84/07)
DE85001167	DOE/LLW—32T
DE85001172	CONF-801210—31-Draft
DE85001173	DOE/ID—12228
DE85001180	CONF-831187—19-Draft
DE85001186	CONF-8309281—1
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DE85001190	SOLAR/0802—84/01
DE85001191	DOE/NBM—5001191
DE85001242	CONF-840767—5
DE85001243	CONF-8406204—1
DE85001244	DOE/EIA—0125(84/2Q)
DE85001245	DOE/ER—0202
DE85001246	CONF-840617—7
DE85001247	CONF-840604—23
DE85001248	CONF-8406167—5
DE85001252	CONF-8409156—1
DE85001253	CONF-840767—6
DE85001254	CONF-840760—12
DE85001256	CONF-840829—3
DE85001259	CONF-830942—88
DE85001261	CONF-830942—87
DE85001262	CONF-8309285—1
DE85001264	CONF-8409142—1
DE85001266	CONF-840387—13
DE85001272	CONF-8406209—1
DE85001275	CONF-8405243—1
DE85001278	CONF-8406205—1
DE85001279	CONF-8406206—1
DE85001280	CONF-8406156—4
DE85001281	CONF-840612—17
DE85001286	CONF-840786—3
DE85001288	CONF-840738—6
DE85001289	CONF-840760—14
DE85001291	CONF-840798—1
DE85001297	SOLAR/0015—84/32
DE85001305	DOE/CH/00178—T23
DE85001324	DOE/ET/25003—T1
DE85001331	DOE/ER/40008—61
DE85001336	DOE/ER/03346—257
DE85001343	BNL—35171
DE85001344	BNL—35124
DE85001345	BNL—35226
DE85001347	BNL—35133
DE85001357	BNL—35178
DE85001360	DOE/JPL/955392—3
DE85001370	DOE/SF/10501—059
DE85001374	DOE/SF/10501—017
DE85001375	DOE/SF/10501—019
DE85001376	DOE/SF/10501—014
DE85001380	DOE/SF/10501—060
DE85001383	DOE/JPL/956786—84/1
DE85001385	SOLAR/0013—84/30
DE85001396	LBL—17827
DE85001417	LBL—18216
DE85001418	LBL—16518
DE85001419	ANL/EES-TM—251
DE85001438	ANL/TM—404-Rev.
DE85001443	DOE/ET/34015—8
DE85001444	SAND—84-0556
DE85001445	EGG—2330
DE85001446	DOE/OR/03054—T11-Suppl.
DE85001447	SAND—84-0522C-Rev.
DE85001449	DOE/MC/20013—T7
DE85001451	EGG-EA—6703
DE85001459	DOE/FE/60177—1664
DE85001464	DOE/OR/03054—T26-Vol.5
DE85001465	DOE/OR/03054—T26-Vol.4
DE85001467	DOE/OR/03054—T26-Vol.2
DE85001470	DOE/ER—0143/2
DE85001474	ANL—84-63
DE85001488	DOE/OR/03054—113
DE85001489	DOE/OR/03054—51
DE85001491	ORNL/CSD/TM—210
DE85001493	ORNL—5992
DE85001495	ORNL/TM—8835
DE85001498	ORNL/TM—9204
DE85001500	ORNL—6084
DE85001508	USGS-OFR—84-450
DE85001513	LA—10161-MS
DE85001520	LA—10215-MS
DE85001525	LA—10013-MS
DE85001540	CONF-840971—5
DE85001542	CONF-8409129—2
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DE85001544	CONF-8409140—2
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DE85001546	CONF-840902—11
DE85001547	CONF-840954—7
DE85001550	CONF-8411104—1
DE85001557	SOL—84-6
DE85001559	CONF-831265—6
DE85001560	SLAC-PUB—3396
DE85001579	DOE/PE/70267—T6
DE85001580	DOE/PE/70267—T7
DE85001581	DOE/PE/70267—T4
DE85001582	DOE/PE/70267—T8
DE85001583	DOE/PE/70267—T5
DE85001584	DOE/RL/01830—T30
DE85001585	SAND—84-8234
DE85001587	UCID—20211
DE85001588	UCID—20217
DE85001589	SAND—84-8178
DE85001590	DOE/ET/53088—154-Pt.A
DE85001591	Y/DW—474
DE85001592	Y/DW—519
DE85001594	DOE/ER/10922—T1
DE85001610	CONF-840937—4-Draft
DE85001611	DOE/ET/20643—T4
DE85001614	DOE/CS/40091—T10
DE85001629	DOE/PC/60044—T2
DE85001685	NIPER—132-PPS-83/5
DE85001691	ORNL/TM—9250
DE85001692	ORNL/TM—9153
DE85001694	ORNL/TM—9096
DE85001700	ORNL/TM—9358
DE85001704	PNL—4937
DE85001705	DOE/EIA—0333(84)
DE85001706	DOE/JPL/956615—84/3
DE85001707	DOE/JPL/956312—08
DE85001726	DOE/NV/10354—1
DE85001730	DOE/NBM—5001730
DE85001731	ORNL/TM—8946
DE85001733	ORNL/TM—9165
DE85001734	PNL—5244-Vol.1
DE85001735	ORNL/Sub—80-7948/1
DE85001736	ORNL/Sub—81-22201/2
DE85001741	UCRL—91383
DE85001743	UCRL—91091
DE85001744	UCRL—91443
DE85001746	UCRL—91098
DE85001749	UCRL—91565
DE85001751	UCRL—91531
DE85001752	UCRL—91330
DE85001753	UCRL—90160
DE85001758	SCL-CR—67-191
DE85001761	CONF-8408111—1
DE85001777	DOE/ET/53003—2
DE85001778	DOE/ET/53003—3
DE85001787	DOE/ET/53088—154-Pt.B
DE85001788	CONF-840922—1
DE85001804	SAND—84-1300C
DE85001805	MHSMP—84-36
DE85001858	CONF-840760—13-Rev.
DE85001861	CONF-840534—3
DE85001865	CONF-8405237—1
DE85001866	LBL—18297
DE85001867	CONF-8405207—2
DE85001870	CONF-8405193—44
DE85001872	CONF-840617—8
DE85001873	CONF-840570—14
DE85001875	CONF-8405214—2
DE85001882	DOE/ER—0145/2
DE85001884	SLAC-PUB—3427
DE85001894	CONF-8405242—1
DE85001897	CONF-840793—5
DE85001901	CONF-840793—2
DE85001906	DOE/ER/03624—25
DE85001910	EPRI-EA—3671
DE85001911	EPRI-AP—3580
DE85001936	UCRL—53564
DE85001937	BNL—35207

File No.	Report No.
DE85001943	DOE/ER/60169—T1
DE85001946	DOE/FE/60338—13
DE85001948	SAND—84-0847
DE85001950	UCRL—53566
DE85002001	LBL-PUB—3044
DE85002006	LBL—18292
DE85002007	LBL—18080
DE85002011	DOE/EML—431
DE85002012	DOE/EML—429
DE85002013	LA-UR—84-2767
DE85002014	LA-UR—84-2773
DE85002020	LA-UR—84-2815
DE85002024	LA-UR—84-2906
DE85002030	LA-UR—84-2989
DE85002032	LA-UR—84-3001
DE85002033	LA-UR—84-2994
DE85002035	LA-UR—84-2943
DE85002036	LA-UR—84-2953
DE85002038	LA-UR—84-2936
DE85002039	LA-UR—84-2927
DE85002040	LA-UR—84-2938
DE85002042	LA-UR—84-3015
DE85002043	LA-UR—84-3007
DE85002045	LA-UR—84-3028
DE85002046	LA-UR—84-3022
DE85002047	LA-UR—84-3044
DE85002048	LA-UR—84-3043
DE85002049	NMERDI—2-67-1135/11
DE85002058	LA-tr—84-30
DE85002061	DOE/SF/00115—T11
DE85002065	LBL—17954
DE85002067	LBL—18259
DE85002069	LBL—18271
DE85002070	LBL—18276
DE85002071	LBL—18275
DE85002073	KY/L—1328
DE85002080	DOE/ER/10618—12
DE85002087	DOE/ER/13004—2
DE85002088	UCID—20212-Rev.1
DE85002090	SAND—84-8177
DE85002092	GJ/TMC—15
DE85002093	DOE/ER/10578—T4
DE85002098	DOE/EV/04321—4
DE85002099	DOE/EV/04321—T2
DE85002103	CONF-840937—5
DE85002104	CONF-841174—4
DE85002111	DOE/BP—280
DE85002112	CONF-840937—6
DE85002113	DOE/ET/34014—16
DE85002117	MLM—3156(OP)
DE85002118	DOE/ER/13164—T1
DE85002121	DOE/ER—0147/2
DE85002131	BNL—51783
DE85002139	DOE/ER/75016—T3
DE85002140	SOLAR/0011—84/01
DE85002142	UCID—20166-Vol.1
DE85002145	CONF-840790—3
DE85002146	CONF-840923—2
DE85002147	CONF-831012—13
DE85002149	DOE-tr—5002149
DE85002150	CONF-8410147—2
DE85750063	BMFT-FB-T—84-177
DE85750064	KFK—3660
DE85750066	BMFT-FB-T—84-164
DE85750067	EIR—516
DE85750068	GKSS—84/E/15
DE85750069	GKSS—84/E/17
DE85780002	INIS-mf—8798
DE85780003	INIS-mf—9039
DE85780004	INIS-mf—9007
DE85780005	INIS-mf—8882
DE85780006	INIS-mf—9036
DE85780007	INIS-mf—9037
DE85780008	INIS-mf—9054
DE85780009	INIS-mf—9042
DE85780010	INIS-mf—9043
DE85780034	INIS-mf—9045
DE85780057	INIS-mf—9069
DE85780058	INIS-mf—9067
DE85780060	INIS-mf—9068
DE85780061	INIS-mf—9057
DE85900017	CEA-N—1434
DE85900023	CONF-8404196—1
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DE85900074	TVA/PUB—84/73
DE85900108	NZERDC-P—74
DE85900111	NZERDC-P—76
DE85900112	NZERDC-P—75
DE85900132	INER—0498
DE85900133	INER—0494
DE85900141	INER—0503
DE85900149	INER—0514
DE85900263	CHER—83-1
TI84013378	NUREG/CR—3663-Vol.2
TI84016795	NUREG/CR—3765
TI84016805	NUREG/CR—3813
TI84751668	VTT-TIED—253
TI84900991	NHA—5492-82/09
TI84901258	EPA—520/5-83-027
TI84901489	GAO/RCED—84-44
TI84901516	GAO/RCED—84-116
TI84901549	NUREG—1026-Final
TI84901580	REG/G—1.89-Rev.1
TI84901771	NP—4901771
TI84901773	NP—4901773
TI84901778	NP—4901778
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TI84901788	NP—4901788
TI84901791	NP—4901791
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TI84901795	NP—4901795
TI84901797	NP—4901797
TI84901798	CONF-8208202—1
TI84901801	ICTIS/TR—26
TI84901832	CONF-830179—Vol.1
TI84901838	CONF-8405234—3
TI84901850	NEANDC(J)—104/U
TI84901864	NEANDC(J)—105/U
TI84901865	NP—4901865
TI84901871	GAO/RCED—84-22
TI84901875	OCS/MMS—84-0030
TI84901899	GAO/RCED—84-168
TI84901910	NSF—81-305
TI84901918	CONF-830179—Vol.2
TI84920453	EPRI-EA—3522
TI84920546	EPRI-NP—3632
TI85000209	NUREG/CR—3786
TI85000909	DOE/IG—0212
TI85000917	DOE/IG—0211
TI85002085	NUREG/CR—3907
TI85750065	GSF-A—2/84
TI85900006	CONF-830682—4
TI85900008	NUREG/CR—3988
TI85900021	NUREG/CR—3899
TI85900022	NUREG—0750-Vol.19-No.5
TI85900029	NP—5900029
TI85900031	STI/DOC—10/237
TI85900032	CONF-821286—1
TI85900036	NUREG/CR—2576
TI85900038	NUREG—1029
TI85900039	NUREG/CR—3824
TI85900040	NP—5900040
TI85900049	NP—5900049
TI85900053	NP—5900053
TI85900062	NUREG—0420-Suppl.7
TI85900068	NUREG/CR—3665-Exec.Summ.
TI85900077	CONF-8306126—12
TI85900085	GAO/RCED—84-17
TI85900087	GAO/RCED—84-143
TI85900094	GAO/RCED—84-43
TI85900095	GAO/RCED—84-27
TI85900096	GAO/RCED—84-190
TI85900097	GAO/RCED—84-180
TI85900098	GAO/RCED—84-178
TI85900198	GAO/RCED—84-46
TI85900199	GAO/RCED—84-79
TI85900256	NUREG/CR—4007
TI85900257	NUREG—0020-Vol.8-No.8
TI85900260	NUREG—1083
TI85900261	NUREG/BR—0051-Vol.6-No.2
TI85900266	NUREG—0750-Vol.19-No.6
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TZ United Republic of Tanzania

UA Ukrainian Soviet Socialist Republic (Ukrainian SSR)
UG Uganda
US United States of America (USA)
UY Uruguay

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VD Democratic Republic of Vietnam
VE Venezuela
VS Republic of Vietnam

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YD Democratic Yemen
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